CHEMICAL
& METALLURGICAL
ENGINEERING

FEBRUARY, 1943

POSTWAR PROSPECTS for PROCESS INDUSTRIES

This "20th Annual Review and Forecast" number of Chem. & Met. deals with economic and technical trends in the chemical process industries and attempts to project them far ahead into the postwar economy. It shows interesting developments in prospect for chemical engineers as new products and processes emerge from the laboratory and must be translated into a new crop of infant industries. It tackles the problem of how best to utilize wartime surpluses of goods and plant capacity. In following the pattern of its distinguished predecessors, this issue should prove most helpful to those thinking and planning for our Chemical Future.

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In this Issue

Volume 50 — FEBRUARY, 1943 — Number 2

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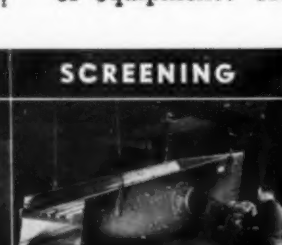

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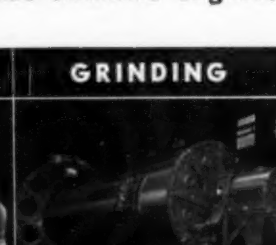

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Mining—Number One War Industry

The mineral products of the earth are the prime necessities of war... and peace

THE SURFACE of the earth provided primitive man with the things he needed for his meager existence but civilization really began when he became curious about its interior. This curiosity has brought us a long way. For the earth has yielded — out of its deep recesses — all the raw materials of modern industry. And today, in the grueling race of production, our mining industry is providing the raw materials upon which depends our survival. Our mines and quarries must supply a long list of materials without which a successful war cannot be fought.

Take steel, for example. War without steel is inconceivable. Steel starts with iron ore, limestone and coke. These are products of mines and quarries. It takes power and heat to get these materials out of the ground, to refine them and to transport them to the point where processing begins. All the subsequent operations culminating in the steel ingot, shape or plate, and in moving the final product to the point of use require power and heat.

The major source of this power and heat is coal.

Production of a ton of steel, it has been stated, requires two tons of coal. Smelting of the pig iron alone, 60,000,000 tons in 1942, required the coking of some 75,000,000 tons of coal. Pig output is expected to rise to 68,000,000-70,000,000 tons in 1943, carrying coal consumption up to 85,000,000 tons. At the same time, output of steel ingots is expected to rise from 87,000,000 to 97,000,000 tons. Think what this means in terms of power and heat.

Another vital metal is copper. Modern armies need copper. This point is dramatically illustrated in a recent memorandum by Robert P. Patterson, Under Secretary of War, in announcing the release of 4,000 men from military service to return to the mines and increase copper production. "In a single minute of combat", Mr. Patterson declared, "a flight of 50 fighter planes shoots away 7 tons of copper. A 37-mm. anti-aircraft gun uses up a ton of copper every twenty minutes it is in operation. Six hundred pounds of copper go into every medium tank, and a ton into the engines and airframe of a Flying Fortress. The Signal Corps alone needs 5,000 tons of copper every month for radio and telegraphic and telephonic equipment. An army without copper would be an army without speed, maneuverability or firepower. It would not last a day in battle".

Seven tons of copper for one minute of combat by 50 fighter planes means from 200 to 700 tons of ore, depending upon its grade. Small wonder that the War Department was willing to release drafted miners from military duties to produce more copper.

But other metals are equally important in war: tungsten, nickel, manganese, chromium, vanadium and molybdenum for alloy steels; zinc for brass and die castings; tin for bronze and bearings; aluminum and magnesium for aircraft; lead and mercury for ammunition; silver for electrical equipment, bearings and solder, and so on. Even relatively insignificant non-metallics, like mica and diamonds, suddenly assume critical importance.

And let us not lose sight of the fact that without adequate energy, i.e., heat and power, production, processing, transportation and the relative comforts to which we have become accustomed would be impossible under war conditions. Coal is the major source of energy in the United States. It supplies more than half the total in normal years.

The railroads of the country alone used 110,000,000 tons in 1942 to move freight and passengers and service their facilities. Utilities consumed over 68,000,000 tons in the production of electric power. Over 135,000,000 tons of coal were consumed last year in maintaining the level of heating comfort necessary for the maintenance of efficiency and morale. The consumption, this year, will be even greater.

In short, the mineral products of the earth are the prime necessities of war.

The nations that control the world's mineral resources and make the most efficient use of them will win the victory.

Before the war, the British Empire and the United States together controlled probably 75 per cent of the world's mineral production. This would have been a most potent weapon in the United Nations' arsenal if the whole strategy of Axis expansion had not been influenced by mineral objectives. Addressing the American Zinc Institute on the subject last April, E. W. Pehrson, of the U. S. Bureau of Mines, estimated that the Axis had improved its position in world mineral resources in the following percentages: iron ore, from 6 to 46; steel production capacity, 20 to 34; petroleum, 1 to 7; coal, 27 to 53; copper, 5 to 10; lead, 7 to 22; zinc, 16 to 27; tin, 1 to 72; manganese, 2 to 30; chrome, 3 to 30; tungsten, 6 to 60. In the light metals, areas now Axis-controlled produced in 1940 54 per cent of the world's aluminum, 49 per cent of the bauxite (the principal source of aluminum) and two-thirds of the magnesium.

This is the eighth of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

Despite these gains, the industrial war power of the United Nations still can outweigh that of the Axis by a considerable margin. It already has begun to surpass it. The problem is to convert quickly our potential mineral resources into implements of war. In this conversion, a heavy burden of responsibility has been placed on the mining industry of the United States as the largest producer of many metals, minerals and fuels. In fact, the United States mining industry began to go on a war basis a year before Pearl Harbor. The curves of demand for domestic copper, lead, zinc and other metals began to rise sharply in 1940, and were paralleled by a rising coal production.

How well the job has been done cannot be revealed in accurate figures in many cases because of censorship. In metals, however, some idea of production gains can be indicated in comparative terms. United States copper production, for example, is breaking all previous records. Aluminum capacity will be more than seven times its annual peace-time average. Magnesium plants now building will have a capacity 100 times the largest yearly before-the-war figure. Molybdenum, of which the United States has the largest single mine in the world, is being made available in record quantity. Zinc, lead and mercury are surpassing expectations in meeting wartime demands, and tungsten, chromium, manganese, antimony and iron and steel are being turned out in record-breaking quantities.

Bituminous coal production in 1942 was 580,000,000 tons, the greatest in history, valued at more than $1,300,000,000 at the mine. Some 430,000 or more men were employed in 1942 and received at least $750,000,000 in wages. Bituminous production in 1939 was 394,855,000 tons, while the output for 1943 is forecast at approximately 600,000,000 tons — another new United States record. The 1942 anthracite output was 59,961,000 tons, valued at over $270,000,000 at the mine. The industry employed some 85,000 men and paid out at least $180,000,000 in wages. The 1939 production of anthracite was 51,487,000 tons, and the forecast for 1943 is 65,000,000 tons or more.

Marshalling the Western Hemisphere's mineral resources, the United Nations have been the beneficiaries of the diversified resources of two continents — in particular of Canada's nickel and coal, Mexico's lead and antimony, Chile's copper, Bolivia's tin, Peru's vanadium, Brazil's iron, and Venezuela's petroleum. With other United Nations contributing their share of metals and fuel, the grand total is an impressive array of potential munitions and matériel to lend assurance of certain victory over the Axis. Sheer weight of metal, properly used, will win the war, and our mineral industry will have played an indispensable and essential part in the inevitable outcome.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

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S. D. KIRKPATRICK, *Editor*

FEBRUARY, 1943

TODAY'S SCARCITIES, TOMORROW'S SURPLUSES

We want to win the war and we want to win the peace. The one is the immediate, the other our long-time objective. All that all of us can possibly give in time and material, thought and energy, must go first of all to speed the victory of our armed forces. We cannot afford to waste time drawing up the blueprints or painting a pretty picture of a bright new world—not as long as this one is still in danger. Yet all of our efforts can prove futile and ineffectual unless we can somehow view in proper perspective the path we have been traveling and its relation to the long road ahead.

This Twentieth Annual Review and Forecast Number of *Chem. & Met.* is an attempt to help in providing that longer look ahead. Current statistics, except for a few basic commodities, cannot be published in wartime and would now mean very little even if the bans of censorship were lifted. But in each of the chemical process industries there have been accelerated changes and war developments that will inevitably lead to a *tomorrow* that is vastly different from *yesterday*. So *today*, while these changes are still in the making, we should face the challenge of the future. We can do this without in any way stinting the war effort if we but realize, as technical men, that change is the very essence of the continued progress of our industries.

In chemical industry, for example, the war has multiplied by many times the normal demands for certain commodities such as nitric acid and ammonia, chlorine and phenol, aluminum and magnesium, and certain plastics and resins. All these today are still relatively "tight," despite greatly expanded production capacities. Yet when the war ends these are the products that will be available in superabundance. Today's scarcities thus become tomorrow's surpluses. How are we best to utilize them? Can each of them become, as did nitrocellulose after the last war, the basis for whole new industries? Is there another generation of infant industries coming along to grow up in this postwar period?

Similar problems are to be found in practically every field that has been stimulated by the war program. They do not always lend themselves to prompt solution because some will involve tedious research and development for which manpower and facilities cannot now be spared. But there are trends that can be charted, problems outlined and assigned for at least preliminary study. Budgets can be made, even if they must be revised with changing conditions. Sales engineers and technical service men, working closely with market research directors, can do a lot now to unearth new needs for postwar products.

Postwar planning, after all, is nothing more than ordinary business planning except for the longer-range viewpoint. It is the kind of programming we have always associated with the progress of the most alert and research-minded of our companies. And, just as the successful commercial development of a new product or process in times of peace is not the sole responsibility of the research or development department, but is a program in which all must share, so is postwar planning a logical function of every department in the business—from management and administration through production, sales, purchasing and even to personnel and accounting. This must not mean, of course, that everybody's business becomes nobody's. Perhaps in the earliest stages the responsibility will be centered in an individual or a committee but the program will make most progress only when it can be fanned out into the whole organization.

Chemical engineers, because of their close concern with both technical and market research as well as with production and sales, can contribute a great deal to the postwar thinking and planning of their companies. They have an unusual opportunity to help in drawing up the specifications of future needs and how they can be supplied.

When American industry goes back to peace-time production, it will leave far behind those who stand still or fail to look ahead in times like these. Postwar planning, to be realistic, calls for practical men with bold minds and plenty of resourcefulness.

POSTWAR MANPOWER

MANPOWER shortages today must not obscure the quite different manpower problems of the early postwar period. Plans made now can greatly alleviate engineering and management troubles later on. Technical as well as personnel officials must participate in this planning.

There are many and varied conditions of the postwar which may confront each individual management. It is not safe to assume any single set of such conditions and make plans accordingly. Each of the varied possibilities and combinations of circumstances should be explored and corresponding plans considered, at least in a preliminary way.

One processing company of our acquaintance has prepared an up-cycle and a down-cycle budget of manpower requirements. The first is based on the assumption that a complete revamping of its plant and technical facilities may be both possible and desirable. The other is based on the view that no technical expenditures will be possible for some time to come. Somewhere between these two extremes is the most probable situation for most plants. But to be forearmed, a scheme to handle either extreme as well as this middle course should at least take preliminary form within the next six months or so.

After manpower requirements have been estimated, legal and personnel officials of each company should go back over old personnel lists to identify former employees who may be entitled to first consideration for reemployment. One can well assume that the present law which gives such persons some preference will be continued or perhaps greatly strengthened. It seems certain that the desire of Congress to provide maximum opportunity for employment for former service men will dictate a policy of preference for men released from the uniformed services.

Some thought should also be given to many who left company employment voluntarily in order to go into other war work and are just as deserving of reconsideration for postwar jobs although, of course, retaining no legal status. The ambition which drove them to such change may prove the best evidence that they are aggressive and valuable employees for the future. Certainly management should also give thought to the reengagement or retention of those skilled workers who have peculiar knowledge of the company's distinctive practices or unusual skill that will always be of value.

In planning postwar manpower policies, any company will do well to keep in mind the necessity for great flexibility and technical resourcefulness. No company can be sure it will be operating on anything like its prewar basis. The best way to anticipate all contingencies with respect to personnel is to give increased attention now to scientific and technical skills.

STRIPPED FOR ACTION

TO COMPLY with the recent order of the War Production Board limiting the amount of paper that may be used during 1943, *Chem. & Met.* and most other technical and business papers have slightly reduced the over-all size of their pages. By stripping off the margin it is possible to print on smaller sheets and thus effect a substantial saving in paper.

In the aggregate this war measure will contribute to the conservation of manpower and materials as well as the use of transportation facilities. Service to the reader has not been sacrificed. In fact the actual size of the type page and, therefore, the editorial content per page, has been slightly increased because we have adopted an improved type of binding that permits a flatter opening of the magazine. Likewise we are discontinuing the tight rolling of copies that has sometimes proved an annoyance to our West Coast readers. We ask you to accept these changes along with our pledge to maintain and endeavor constantly to improve our editorial service as far as humanly possible in face of war restrictions.

WASHINGTON HIGHLIGHTS

PRICES below production costs are being fixed for certain goods by O.P.A. in accordance with a weird theory. Its academicians say that it is all right to fix a ceiling price below cost on certain goods because the manufacturer can make up his losses on these out of profits on other commodities which he makes. This naive explanation seems to root in a desire to regiment industry irrespective of the long-time effect. Policies like these make industrial cooperation all the more difficult, creating needless controversy and delay in the war period. Specific examples of such false reasoning can well be brought to the attention of members of Congress who are the only ones having any influence for correction. It is important, however, that specific and accurate information be supplied so that a cooperative legislator can work constructively for relief of injustices without appearing to interfere with a sound policy of inflation control.

DECEPTIVE DATA from O.P.A. were issued during January, in one case of far-reaching significance. Officials of the Price Administration wanted to demonstrate that ceilings on prices have not destroyed the profit margin of business. They tried to do this by comparing for the past three years the "percent return on net sales." They give figures which apparently they hoped would be understood as profits, since immediately adjoining the table there is a discussion labeled "profits." One would think from these highly deceptive figures that the chemical manufacturers made from 21 to 27 percent profit on their sales. If any management is charged with this, it would do well to point out that even the economists who prepared these figures knew better; and a careful reading of what was said shows the absurdity of such a claim.

DEFERMENT OF TECHNICAL MEN may be somewhat aided by recent occupational bulletins, especially by No. 43 which governs technical, scientific and management services of engineers, chemists and other professional people. But it remains definitely the job of management to prosecute each case vigorously with the local board. Members of these boards are so busy that, even with the best of intentions, they can know almost nothing about the sorts of deferments of specialists which Washington not only recognizes but also recommends.

CHEM & MET REPORT ON . . .

Postwar Prospects for the Chemical Process Industries

Herein the editors of *Chem. & Met.* sit back to take a long-range look at the probable future of the industries dependent on chemical raw materials and on the underlying technology of chemical engineering. Of necessity they must first consider some of the broader social, economic, and even political factors that threaten to force our postwar economy into a new and different pattern. Then they outline some of the impending industrial problems and the procedures being employed by groups that are already well advanced in planning for their postwar solutions. Attention is naturally given to some of the embryonic developments that are yet to emerge from the warm womb of the laboratory and must soon be reared by chemical engineers as a new generation of infant industries.

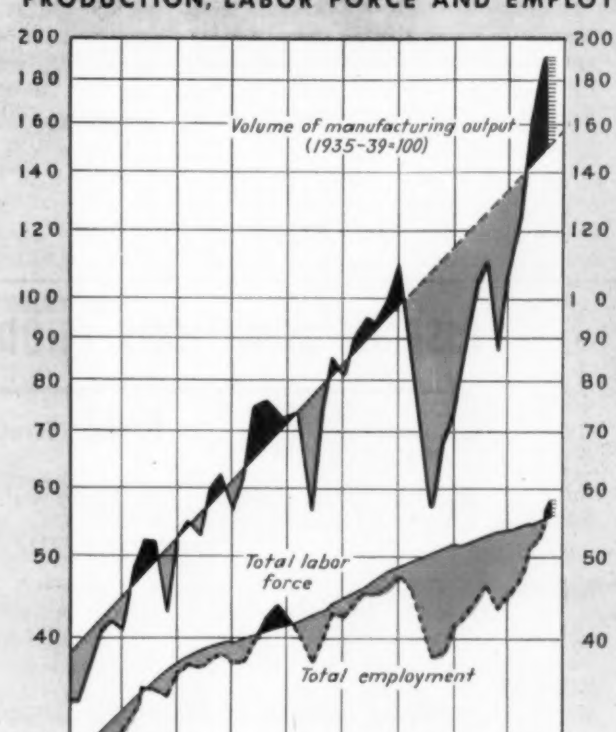
An accompanying check list of pertinent questions to be asked of every technical man interested in postwar planning forms an additional and useful feature. Finally, there are the specific summaries and forecasts for the different process industries, followed by 24 pages of concentrated facts and figures on the commodities needed to complete the whole broad picture of our "Chemical Future."

ANYONE CONCERNED REALISTICALLY with the postwar prospects of the chemical process industries must realize that that future will be determined by social and political as well as economic and technical forces. If only the latter were involved, then the engineer and economist between them could draw up a likely plan with some assurance that it might ultimately be followed. Unfortunately, sociology and politics do not lend themselves to quantitative analysis. Nor is economics, as we know it, yet an exact science.

So, as the engineer projects forward his thinking into the period of reconstruction and readjustment that must inevitably follow the winning of this war by the United Nations, he finds many intangibles that are difficult to evaluate. He can proceed safely only on the basis of certain assumptions, which for the purpose of this discussion can be summed up in what we shall call the continuation and further development of the "American way of living." That means, at least to us, the maximum opportunity for private enterprise and individual initiative—just as long as the most good is accomplished for the most people.

Nearly all postwar plans start with the Atlantic Charter and the four freedoms for which we are fighting. The fourth of these, the freedom from want, is the responsibility that is most often consigned to industry. That is where it logically belongs. Unless there is the enterprise to produce the goods and services that provide the opportunities for men and women to work and advance, there is no substitute short of state socialism and economic dictatorship. But nevertheless we should not lose sight of the fact that industry has for

PRODUCTION, LABOR FORCE AND EMPLOYMENT



F.R.B. Index of Production
Employment and Labor Force in Millions of Persons

its prime function not to provide employment but to produce goods and services. Both can and should go together—rising levels of employment and rising standards of living. That is the long-time history of this country as the accompanying chart of production, labor force and employment shows so well for the period 1899-1942.

Not all responsibility for total postwar employment can be laid at the door of manufacturing industry. Agriculture and mining, and forestry and fishing, normally account for more jobs than does manufacturing. Today the armed forces and professional and governmental services are almost equally important. That there must inevitably be a considerable change in employment distribution is evident from the illustration (see page 100) which was prepared by the General Electric Company's special planning committee to compare the last full prewar year (1940) and the estimated war-production peak of 1943 with the situation to be expected two years after Victory (V + 2). All this is on the assumption, of course, that we succeed in attaining full employment by that time.

It will be noted that the total employment projected for 1943 is 63 millions persons or about 6 millions more than the National Industrial Conference Board defines as the normal labor force of this country. That this peak can be reached at the same time we are maintaining and fully equipping an Army and Navy of at least 8.5 millions is evidence that we must draw heavily on "emergency" supplies of women and older- as well as underaged employees. Their ultimate withdrawal from the labor force will naturally help make room for the men who return from the armed services.

Other changes which this study projects are increased employment in trade, distribution and finance, and in domestic and engineering construction. The drop in factory employees from the war peak of 18 millions to a peacetime level of 14.5 millions is impressive but the V + 2 figure represents an actual increase of about 40 percent over 1940. Hence this calls for fullest utilization of peace-time facilities plus whatever new industries can contribute to capital formation.

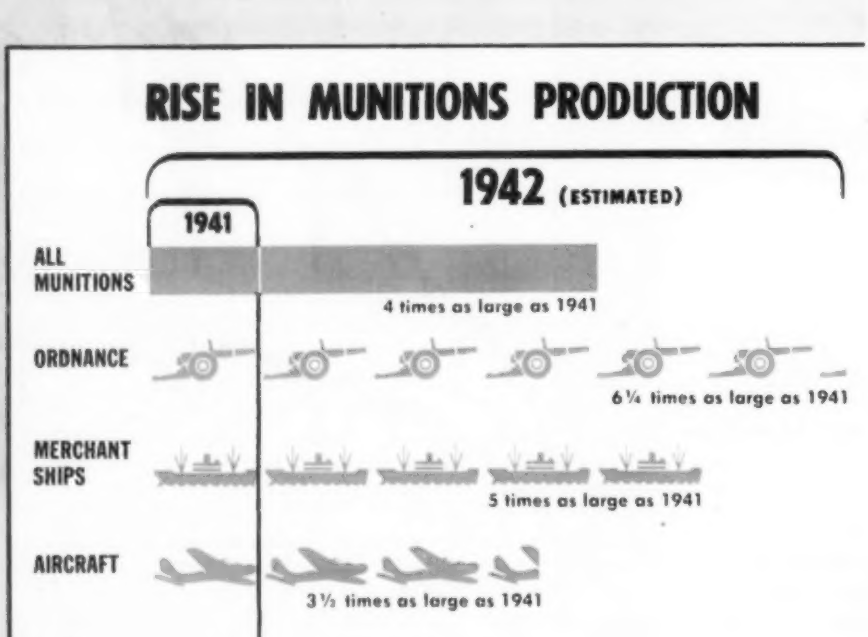
As noted previously, high capital formation and a high level of employment go hand in hand. During the 1920's capital formation was about 21 percent of the gross national output and we were within 3 percent of full employment. During the 1930's, capital formation averaged considerably less than 20 percent and we had a large unemployment problem.

The first step in the General Electric committee's program, therefore, was to study the components of the gross national output for 1940 and project these for the war peak of 1943 and the first "normal" postwar year—again assuming full employment. The chart (p. 101) shows these relations as war expenditures which have been expanded to over \$60 billions and later contracted to \$10 billions. The authors (R. P. Gustin and S. A. Holme, *Harvard Business Review,* Summer, 1942, pp. 459-472, "An Approach to Postwar Planning") make this interesting deduction:

> "Of the \$11.5 billions for plant and equipment, \$8 billions will be needed to keep up with improvements in production techniques and to keep our industrial machine up to a high level of efficiency. The remaining \$3.5 billions would be for plant expansion and new products."

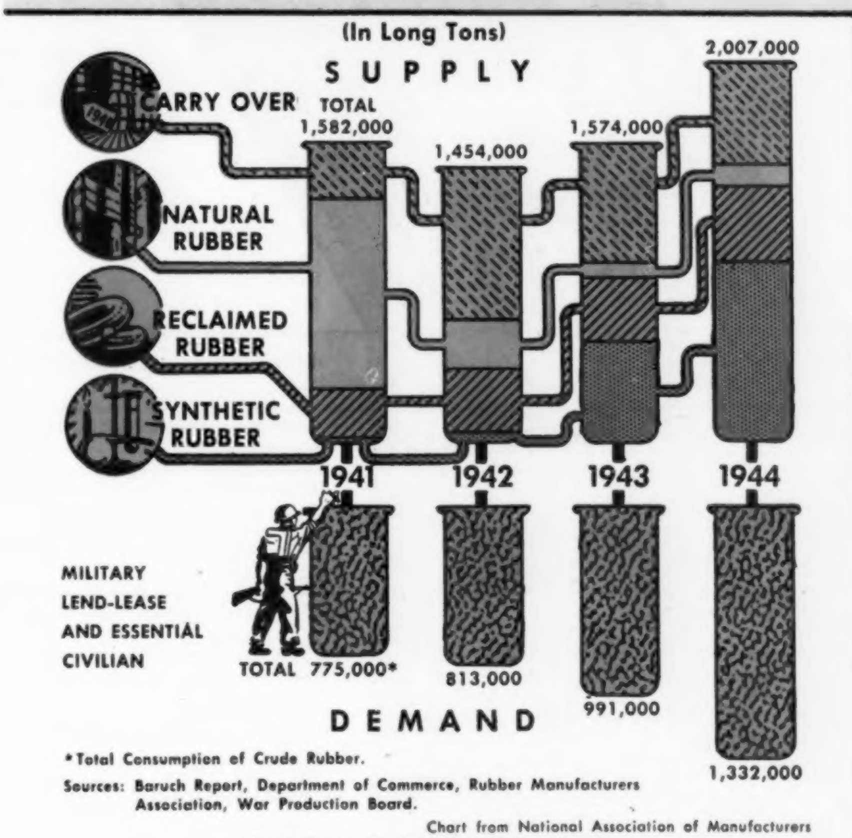
What are some of these new industries that offer promising opportunities for postwar development? If past experience is a trustworthy guide, many of them will grow out of the broad fields covered by the chemical process industries. Just as the first World War stimulated the developments that gave us a great synthetic organic chemical industry—with dyestuffs, plastics and resins, lacquers and solvents, rayon and the synthetic fibers—so this more gigantic conflict seems certain to result in other new or largely expanded "chemical" industries. Of these synthetic rubber, light metals and plastics have received most popular attention but evidence that there are at least fifty other fields worthy of postwar attention is seen in the accompanying list of "infant and young industries." This has been compiled in its present tentative form by Richard M. Lawrence of the Development Department, Atlas Powder Co., Wilmington, Del., who would welcome both criticism and comment. These will not receive further elaboration here except in their relations to the different process industries for which postwar trends are summarized later in this report.

Before presenting these industrial summaries, however, the reader's attention is directed to the "Check-List of Questions for Postwar Planning" which follows immediately on pages 98 and 99. This set of questions is based on similar inquiries prepared by the Industrial Advisory Board of the Committee on Economic Development which was established by private industry last May at the suggestion of Secretary of Commerce Jesse H. Jones. It has been adapted to the form of a check list primarily to emphasize the important fact that postwar thinking and planning concern every department and therefore every man in an industrial organization. It is not, by any means, a responsibility solely of top management. Just as a research department alone is powerless to originate new products and carry them



through to successful commercial exploitation, so is the development of a postwar program an assignment that calls for coordinated effort on the part of all departments and individuals.

Opposite the questions cited in the accompanying list are check marks to emphasize the various departments of a company which should accept responsibility for initiating such inquiries and following them through to successful conclusion. Those companies that have not yet organized or set up the machinery for carrying on long-range studies of this sort will do well to familiarize themselves with the plans and personnel of the Committee for Economic Development. Its chairman is Paul G. Hoffman, president of Studebaker, its vice chairman is William Benton, vice president of the University of Chicago, and former president of the Benton & Bowles. Its board of trustees includes fifteen executives and engineers from a wide range of industries—men of the calibre of Ralph Flanders of Jones & Lamson, M. B. Folsom of Eastman Kodak, Charles K. Francis of General Foods, Charles R. Hook of Armco, Charles F. Kettering of General Motors, and Reuben S. Robertson of Champion Fibre. Chairman of the Industrial Advisory Board is David C. Prince, retiring president of the American Institute of Electrical Engineers and a vice president of General Electric. He has headed the special planning committee of his own company since its inception and much of the technique now recommended by the Industrial Advisory Board has proved useful in the practical experience of General Electric. Present offices of the committee are in Room 3311 of the United States Department of Commerce Building in Washington, D. C.



The balance sheet of the rubber situation

Postwar Prospects for Process Industries

HEAVY CHEMICALS

Don't look for spectacular developments in heavy chemicals but count on steady growth and progress largely in step with the advance of industry as a whole. Some commodities like ammonia and nitric acid, chlorine and phenol, have been greatly stimulated by war demands and will recede unless important new uses not now in sight are developed for postwar exploitation. Staples like sulphuric acid, soda ash and caustic soda—generally regarded as barometers of chemical industry—have been straining at expanded plant capacities but this year's increases in the neighborhood of 12 to 15 percent over 1941 are not out of line with those in some "good" prewar years. Production will continue to increase through the current year which is expected to represent the wartime peak. It will find the heavy chemical industry well on the way to doubling the 1939 volume of its output. Sulphuric acid will remain the cheapest acid and therefore the most widely used in industry. Biggest markets on the horizon will still be fertilizers, petroleum and chemicals—all with opportunities for considerable expansion.

Nitric acid, as previously noted, may well be in for a nose dive unless the present slow trend toward more concentrated fertilizers opens up a more promising outlet for ammonium nitrate and ammonium phosphate. Nitrated products in the organic field—such as the nitroparaffins—have interesting potentialities but do not yet loom large as acid consumers. Hydrochloric acid is likely to find increasing use in acidizing oil wells and in certain new petroleum processes.

The alkalis have their fortunes largely tied to glass, rayon, petroleum, rubber and aluminum—all fields that are of increasing peacetime as well as military importance. Chlorine producers with perhaps a million tons at their disposal, are certain to seek new markets and, if possible, to preserve and develop further such important existing outlets as the chlorinated hydrocarbons.

SYNTHETIC ORGANIC CHEMICALS

Here is an industry that will emerge from the war period with greatly expanded capacity, improved raw materials and processes, and hungry for new and larger markets. The war has definitely proved that the industry can "tailor-make" its products to fit practically any specification of properties and performance. Organic-chemical engineering is the engineering of the future in the opinion of most students of postwar prospects.

Last year this industry set an all-time peak in production and is expected to gain another 25 or 30 percent in 1943. Coal-tar crudes and intermediates, especially those destined for plastics, rose sharply. Synthetic medicinals showed an outstanding development that seems certain to con-

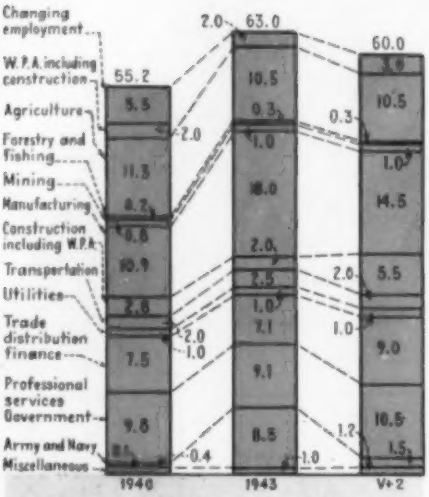
CHECK LIST o

for Chemica

Research	Development	Production	Purchasing	Accounting	Sales	Personnel	Management and Administration	
X	X	X			X		X	What new products are in research or development that could be marketed immediately after the war?
X		X		X	X		X	What older products should we prepare to revive and which should be abandoned permanently?
	X	X			X	X	X	What engineering, design and other development work is required to put the new products into production?
	X	X			X	X	X	When and how should we schedule this work in order not to interfere with war work now under wdy?
	X	X	X	X		X	X	What plans must be made to allocate men, money and equipment for new product development?
X	X	X		X	X	X	X	What factors in our case tend to hold up prices and hold back product improvement? How eliminate them?
	X	X	X	X			X	What plans must be made to convert our plants to peacetime production? How soon should such plans be available?
	X	X		X			X	How long will conversion require? How much will it cost? What if any tax questions are foreseeable?
X	X	X					X	What changes can be made in plant layout during reconversion to improve operating efficiency?
X	X	X					X	What technical improvements developed in war work can be adapted to postwar operations?
X	X	X	X				X	What equipment purchased for war work can be used for our standard products or for new ones planned?
X	X	X		X			X	What equipment should be scrapped and replaced to improve quality or to lower cost of production?
X	X	X		X			X	What equipment will be useless through idleness or require a more rapid rate of obsolescence?
X	X	X					X	Which plant buildings, if any, should be torn down, replaced or repaired?
X	X	X					X	Should we now engage an outside engineering firm to advise us on plant conversion?
	X	X	X				X	Will our regular suppliers be able to furnish needed materials and equipment? If so, on what schedule?
X	X	X	X				X	Have any newly-developed or cheaper materials resulted from war research that could be used in our products?
X	X	X	X				X	Can we determine now what imported materials may be necessary? If so, how and when available?
				X			X	Is our company preparing so far as possible to build up ample cash reserves ("seed money") for the postwar program?
X	X	X		X			X	Are we building up proper depreciation and obsolescence reserves on our plants and equipment?
				X			X	Are we in touch with banks or other outside capital in case our own reserves may not prove adequate?
		X	X	X	X		X	How can we avoid unduly large inventories of raw or semi-finished materials for which postwar prices may drop drastically?
X		X			X		X	What plans should we make now for marketing the quantity of products we hope to sell in the postwar period?
X	X				X		X	To what extent should we include changes in selling methods made necessary by war controls and other factors?
			X		X		X	How can we continue to keep in business the key dealers or key accounts that give us the bulk of our peace-time business?

Postwar Questions
Process Industries

	RESEARCH	DEVELOPMENT	PRODUCTION	PURCHASING	ACCOUNTING	SALES	PERSONNEL	MANAGEMENT AND ADMINISTRATION
What plans should we use during the war to retain the goodwill of our former dealers and customers?	X					X		X
What plans should be used now to keep our trade marks and brand names before our customers by advertising or other means?	X	X				X		X
Toward what functions should our advertising copy and other promotional work be directed during the war?	X	X				X		X
Should we consider new channels of distribution? Based on new sales estimates, how many salesmen will be needed, and where?	X					X		X
Are we now contacting the customers and fields from which we expect to obtain most of our postwar business?	X					X		X
How can we stimulate potential users to include our products in their postwar planning?	X	X				X		X
How far should we go in informing customers and prospective customers about our own postwar plans?	X	X				X		X
Are we making full use of market research to determine sales potentials, probable volumes, sales policies and methods?	X			X		X		X
Should we consider installing a market research department to assist us in meeting our postwar problems?	X					X		X
As producers of primary goods, are we fully aware of the plans and facilities of the users of our products?	X	X	X			X		X
Should we consider greater decentralization to give individuals or departments more responsibility for new products and problems?	X	X	X			X	X	X
To what extent are we maintaining governmental and foreign contacts to assure best information on foreign trade policies?						X		X
What are the manpower needs for making and selling new products? Where obtained? How shall they be trained?			X			X	X	X
If retraining of war production personnel is necessary, what type of program should be developed?	X	X	X				X	X
What provisions should we make for rehiring, training and assigning former employees returning from military services?	X	X	X	X	X	X	X	X
Should we set up a dismissal wage plan for workers we are forced to let go after the war?			X		X	X	X	X
When should employees be informed of company plans to provide maximum postwar employment?	X	X	X	X	X	X	X	X
How should we plan to interest labor, so that it will play its proper part in our postwar program?			X			X	X	X
Should company endeavor to sell some of its properties or buy others after the war? How will this affect postwar plans?	X	X	X			X		X
What studies should we make on changes that will take place in income distribution?	X				X	X		X
Should we put into effect a program for further decentralization of manufacturing facilities?	X	X	X			X	X	X
What part should we play in community planning for postwar period in cities where we have plants?			X			X	X	X
Are we helping trade associations and other industrial and technical groups to promote postwar planning?	X	X	X			X		X
Are we prepared to contribute such information as we can reveal with propriety to such outside agencies?	X	X	X			X		X
Can we contribute data to show extent to which private enterprise is actually planning to produce high postwar employment?	X	X	X		X		X	X



Estimated changes in employment
(In millions of persons)

tinue to gain momentum. The only organic group to show a decline was the coal-tar dyes which is an interesting contrast with the situation in World War I.

SOLVENTS

How solvent will the solvent industry be after all this is over? That's a question many people would like to see answered in other terms than political expediency and farm-bloc economics. With ethyl alcohol production up to five times the largest output in normal times, with more isopropyl than we formerly had of ethyl, with methanol up 50 percent and toluol and benzol production to be multiplied by Factor X, it is certain that the industry is going to have to look for new fields to cultivate. Fortunately, synthetic rubber, resins and plastics are going to need much larger volumes of solvents than ever before, in both their manufacture and application. Fortunately, too, in the case of ethanol is the fact that fully half of its production is coming from the whisky distillers who presumably will revert to their own business after the war has further depleted the stocks in their bonded warehouses.

The consumer stands to benefit considerably as a result of the intercommodity competition that seems certain to plague the postwar solvents industry. Because anti-knock motor fuels will be the ultimate market for our benzol and toluol (or their derivatives) and perhaps for the alcohols, the consumer can begin to think of solvents in terms of 15 to 20 cents a gallon rather than 35 to 50 cents as i prewar days. Such prices will come if they can open up large volumes of new business. They will not come, of course, if Congress in its wisdom decides that subsidized chemurgy is the best solution to the farm problem.

PLASTICS AND RESINS

Governmental buying of greatly increased volumes of such plastic raw materials as phenol, styrene, methanol and formaldehyde and of such finished plastics as the vinyl chlorides and acrylic resins will mean lower prices all along the line once Uncle Sam withdraws from the plastics market. Then the industry will have to do its quick-change act in jig time. The backbone of the prewar business was the large number of applications calling for comparatively small quantities of plastics. That is no longer of most importance. The war has shown that uses requiring large volumes of materials—bomber noses, for example—will some day completely overshadow the small outlets and will thereby add greatly to the stature of the plastics industry of the future.

Already the industry is talking in tons rather than pounds. Last year, according to the Tariff Commission, the production reached well over 200,000 tons. This is insignificant when compared with 100,000,000 tons of steel but when it is put alongside of 300,000 tons of magnesium, 75,000 tons of tin or 600,000 tons of zinc, and when it is realized that plastics are lighter than all metals except aluminum and magnesium, we get a better basis for talking about the Plastics Age of the future. Maybe it is already here.

RUBBER—NATURAL OR SYNTHETIC?

In a forward-looking article in a recent *Atlantic Monthly*, Arthur Kudner writes:

> "I think it is entirely possible that in five years a rubber tree will be as foolish economically as a wild strawberry. . . . I talked of this recently with the erstwhile manager of one of the leading rubber plantations of the Far East. Somewhat to my surprise, he agreed. 'I have been figuring,' he said, 'and on the basis of what we know even now, I can produce more rubber with 300 men in a factory than I can produce with 10,000 men on a plantation."

This is the basis for an argument that time and future political and technological developments will have to settle. We have ourselves talked with a former research director of the Rubber Institute in Batavia, who holds that natural rubber can be so improved by incorporating certain chemical ingredients (e.g. products made by destructive distillation of natural rubber itself) that it will recapture even the special-purpose applications for which the synthetic product is admittedly superior. But an eminent American research director tells us that inevitable improvements in the technology of polymerization will make it possible to "tailor-make" synthetic rubbers that can completely displace the natural product. He points out further that no true synthetic has ever failed eventually to displace its natural rival and he cites indigo, camphor and ammonia to prove his point.

Frankly, we are still on the fence. If technology and private enterprise are left unhindered to work out this problem in their own way, we can at least be certain that we will have better and cheaper rubber products than ever before—whether of natural or synthetic origin, or both.

RAYON AND SYNTHETIC FIBERS

What may be expected to happen to rayon after the war is fairly clear from a qualitative if not from a quantitative viewpoint. But the one big imponderable is the place of silk in the postwar textile picture. Even before the war it had become progressively less important, being firmly entrenched only in hosiery and certain luxury goods. Then came nylon and in a very short time it had succeeded in undermining even these uses.

World politics may revive the use of silk to some extent in the afterwar era, but it can probably never stage a major comeback. Nylon and other synthetics will have become the mainstays for the natural fibers' former markets. Nylon's return to civilian channels will also cut into certain wartime applications for the older rayons, as in hosiery, but here nylon will meet strong competition from high-tenacity cellulose-based yarns and from new fibers still in the laboratory.

In the past, cotton and silk have been the fibers to feel the chief impact of the synthetics. Wool, it is safe to predict, will be the next to have to fight for its traditional position. New cellulose-based rayons of superior air entrapping ability will vie with protein fibers and true synthetics for wool's market. Present-day heat-insulating materials, as well as kapok and other substances used for their buoyancy, may well find themselves in a life or death struggle with the new air-bubble viscose fibers.

The often-mentioned possibility of making textiles without weaving is not yet in sight for ordinary fabrics but the war has developed certain industrial products from plastic impregnated fibers which holds consid-

erable promise. If these unwoven fabrics develop for other uses, the textile industry's loss will certainly be the chemical industry's gain.

OILS AND FATS

MAJOR problem of the oils and fats industry immediately following the end of the war will be to help feed the millions of people in the occupied and conquered countries. The current development of domestic and South American oils as substitutes for such Far Eastern oils as coconut, palm, tung, perilla, and rapeseed, which are not now available, may result in permanent reduction in the quantity of these oils required by American industries. Vast potential sources of flaxseed, castor seed, oiticica and babassu kernels already exist in the South American Republics and are now being exploited in greater measure than ever before. The postwar period should also see an increase in the production of such oils as tucum murumuru, cohune and ouricury—all of which are substitutes for coconut. Recent government-supported expansion of the cultivation of oil-bearing products in the United States has further emphasized to our agriculturists the importance and value of farming for industrial as well as edible consumption.

It is entirely possible that the Western Hemisphere may become self-sustaining with regard to vegetable oils. The extent to which this can be accomplished will depend on the development of machinery and on problems of finance, labor competition, shipping facilities and tariff barriers.

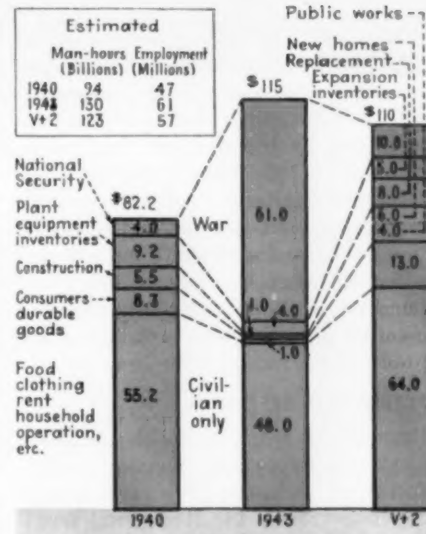
Increasing use by the soap industry of newly developed fatty acids and combinations of fatty acids may partially relieve the use of coconut, palm and other imported oils. Considerable research is being devoted to catalytic and other processes for deriving new products from fatty acids.

LIGHT AND OTHER METALS

ALUMINUM, magnesium and the high-strength alloy steels all bulk large and important in the postwar picture. Donald Nelson, in his 1942 report for WPB, tells us that we are ultimately to have a total supply of 3 billion lb. of aluminum, which is almost ten times the 1939 figure. Furthermore, that by May we shall be independent of foreign ore imports and by September we'll be able to supply Canada's bauxite needs as well. He reported that magnesium production at the close of 1942 was at the rate of 260 million lb. and that we are well on our way to a capacity of 600 millions—which is almost a hundred times the 1937 output.

It seems safe to predict that anything that flies, runs, moves, or is otherwise mobile or motive, will offer a potential market for these light metals and their alloys. But they will have increasing competition from plastics and from recently developed thin-section highly alloyed steels that are now able to do twice the work of ordinary low-carbon products.

Reference should also be made, in passing, to an electrochemical development resulting from the tin shortage. This is the plating of strip steel-plating before fabrication and at plating speeds a hundredfold faster than those of the past. It has brought about an entirely new situation as to the major control of the metal-plating



Components of gross national output (In billions of dollars)

industry, which in prewar times was largely in the hands of the automobile makers. Today the steel companies are taking over control. Electrogalvanizing, electrotinning and electrocoppering are already included in the steel industry's program. Important economies are possible when all the plating, including the final chromium and other coatings, is carried out before the sheet is spun or pressed into the large variety of finished articles.

PULP AND PAPER

PAPER or pulp products treated with synthetic resins to make them moisture or grease resistant have been finding increasing use in containers as substitutes for metal or glass. Some of these markets will undoubtedly be lost after war restrictions have been removed but enough will remain to form the basis for an important post-

INFANT INDUSTRIES FOR POSTWAR DEVELOPMENT

This list of infant and young industries which are expected to experience rapid growth in the postwar period has been compiled by Richard M. Lawrence, Development Department, Atlas Powder Company, Wilmington, Delaware.

- Additives for petroleum products
- Air conditioning
- Aluminum
- Aviation, private and commercial
- Dehydrated foods
- Dry cleaning solvents
- Electronic devices
- Fast-drying printing inks
- Fertilizers with secondary and trace materials
- Fiber glass
- Fireproofing compounds
- Flavor stabilizers
- Flotation reagents
- Fluorescent lights
- Frozen foods
- Hormones
- Household insecticides
- Hydroponics (soil-less agriculture)
- Infant foods (and special foods for the aged)
- Instruments for automatic control
- Lignin derivatives
- Magnesium
- Paper bottles (milk, lube oil, etc.)
- Phosphate detergents
- Plasticizers
- Photocopying processes
- Plywood
- Powder metallurgy
- Prefabricated housing
- Rural electrification
- Rural food lockers
- Rustproofing
- Seed disinfectants
- Soapless soaps
- Soil bacteria
- Soil disinfectants
- Sound insulation
- Sporting goods
- Stream pollution control
- "Street steam" (community boiler houses)
- Sulfa drugs
- Synthetic resins: Plastics . . . Plastic fibers . . . Adhesives . . . Ion exchange resins . . . Surface coatings
- Synthetic rubber
- Television
- Textile finishing: Crease-proofing . . . Fireproofing . . . Shrink-proofing . . . Waterproofing . . . Mildew-proofing
- Tropical medicines
- Vitamins
- Water-thinned emulsion paints

war industry. Greater use of alpha cellulose for chemical processing promises more peace-time competition with cotton linters. Another trend, interrupted by the war and sure to be resumed, is the installation of more bleaching units in pulp mills. We can also expect the postwar construction of more large kraft mills to replace the high-cost plants that were the first to be closed down and dismantled once the war curtailed paper production.

PETROLEUM REFINING

PETROLEUM refining has become our most war-important chemical manufacturing industry. We are largely dependent on it for three vital munitions—synthetic rubber, aviation gasoline and toluol for T.N.T.—not to mention a score of special products that are essential in mechanized warfare.

Perhaps two-thirds of the country's butadiene requirements will come from refinery and natural gas fractions—either by catalytic dehydration of butane and butylene or through thermal cracking. Demands for high-octane gasoline have skyrocketed since Pearl Harbor yet the industry is filling all these demands and at the same time constantly improving processes and the quality of the blends produced. Most military strategists agree that the superiority of American made aviation fuels will prove a major factor in winning this war.

At least two-thirds of the bombs being dropped on our enemies today are filled with T.N.T. made from petroleum toluol. One company alone has a contract to provide more toluol than did the entire coal-products industry in World War I. What is to become of this production as well as our greatly increased output of benzol? The answer is undoubtedly to be found in improved motor fuels for postwar use. Tetraethyl lead may yet find a real competitor among organic additives. The industry itself will become more actively engaged in producing synthetic organic chemicals for plastics, medicinals, paints and other things that make life more livable. The next ten years may well become the "Decade of Petroleum Chemicals."

GAS AND FUEL

THE INTER-FUEL and inter-energy competitions that lie ahead are certain to have important chemical engineering implications. Present war-stimulated demands for solid fuels will undoubtedly decline drastically in the immediate postwar period. Fluid fuels, i.e., petroleum and gas, will inevitably be cheaper than ever before and more abundant as the new pipe lines are completed and super-tankers again move along ocean and inland waterways. Both natural and manufactured gas should continue the gains they have recently been making in the industrial market.

Electric energy has had to be rationed despite increased steam-power and water-power facilities that have given us a record output. Following some readjustment to peace-time loads we may expect increased energy demands that should be supplied at ever lowering prices.

FERTILIZER CHEMICALS

UNPRECEDENTED food requirements make certain that 1943 will place a heavy demand on the producers of fertilizers. The uptrend is likely to continue into the postwar years. This country will probably have to feed many of its Allies and many people in now-occupied areas for some time after hostilities cease. Hence it is important that we know what we face in the way of postwar competition for chemical plant foods.

Potash will again depend to some extent on politics. When hostilities cease there presumably will be at least a half dozen nations free to develop their potash resources and all can be expected to seek American markets. Should we again permit duty-free imports in order to pamper the farmer or should we put a floor on prices and insist that foreign goods should not be sold here at less than our cost of production? We shall hear more of such proposals when the time comes to decide whether we are going to throw overboard our very considerable investment in a very efficient potash industry.

Phosphates will continue to follow closely the general fertilizer trends. In addition there will be new export requirements with renewed competition from our newly found friends in Northern Africa. Again political and economic factors will determine the extent to which U. S. producers can recapture the European markets they once controlled.

Nitrogen will be in increased demand to stimulate many food crops for the postwar market. This will aid in absorbing some of the huge ammonia production which might be continued after military explosives are no longer needed. But it cannot absorb the entire production—at least if present formulas prevail. Hence the industry is working in cooperation with the agricultural leaders in formulating a program for use of the maximum quantities of nitrogen that can be economically applied in post-war years. Ammonia so supplied, probably in the form of ammonium phosphate or nitrate, should be available at a very low cost.

GLASS AND CERAMICS

GLASS PRODUCTS and ceramics are two fields which are likely to present some interesting contrasts after the war, largely due, we think, to the different attitudes which the two industries have taken in the past toward their products. On the one hand, ceramic industries have been pretty much inclined to take their products for granted. True, they have improved them, and have searched in somewhat desultory fashion for new markets. Glass makers, on the other hand, have in the past ten years gone all out for all possible new uses and have developed many which will be with us long after the war.

Recognizing that glass has many useful characteristics in addition to the transparency which was formerly its most used property, they have developed applications depending on its corrosion resistance, its ability to be drawn into fibers, its ability to form a vesicular structure, its resistance to heat, and its mechanical and dielectric strength.

Both products, being made from plentiful raw materials, have been widely substituted during the war for scarce metallic materials, but in the case of ceramics, many wartime uses will disappear or at least decrease in the postwar period while many of the newer glass uses may be expected to expand even beyond their large wartime totals. There will doubtless be considerable return to metal for packaging, at the expense of glass containers, but this may well be offset by continued increase in glass for cooking utensils, for heat and electrical insulation, for fabrics, for building construction when the postwar building boom gets under way, for plate when the country is again able to satisfy the tremendous pent-up demand for new automobiles.

CONCLUSION

SUCH then is the multi-colored picture of postwar prospects in the chemical process industries. Through all of them runs the common bond of a creative technology that is straining for the opportunity to produce more and better products at ever lower costs. The extent to which it can succeed in accomplishing this worthwhile objective will depend largely on the resourcefulness of its practitioners and the opportunity that is afforded for individual initiative and private enterprise.

COMMODITY REVIEWS

Sulphuric Acid and Sulphur

Sulphur mined and sulphuric acid produced both established new highs in 1942, the former reaching an estimated 3,460,000 long tons, and the latter, approximately 12,520,000 short tons (50 deg. Be'.). Although acid capacity was not badly strained, the supply situation at least was tight.

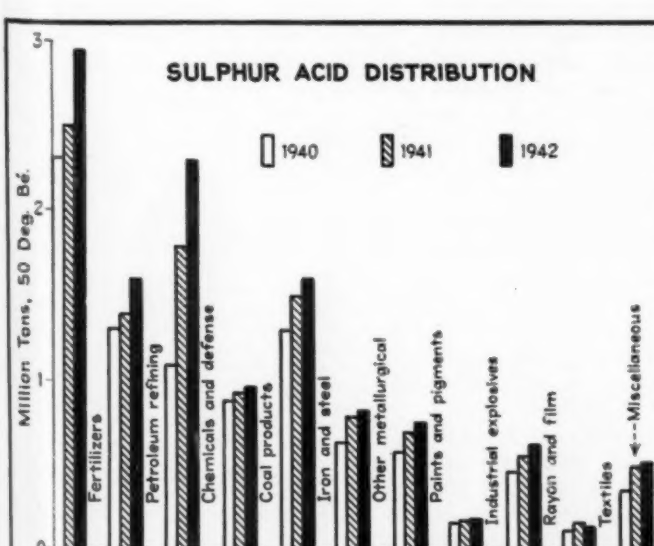
Although some estimates of United States sulphuric acid capacity place the total as high as one-third more than the production attained in 1942, assuming that the plants are pushed to their limit, nevertheless 1942's output appears to have very little below the practical capacity, and much in excess of any previous year. Some prognosticators anticipated an actual shortage in 1942, but this did not develop, although scant stocks were drawn on in some parts of the country, and in most, there was no evident excess. Acid was tight but not short. The country-wide picture was that of a close approximation of balance between production and consumption, with acid sometimes hard to get in certain areas, and more plentiful in others.

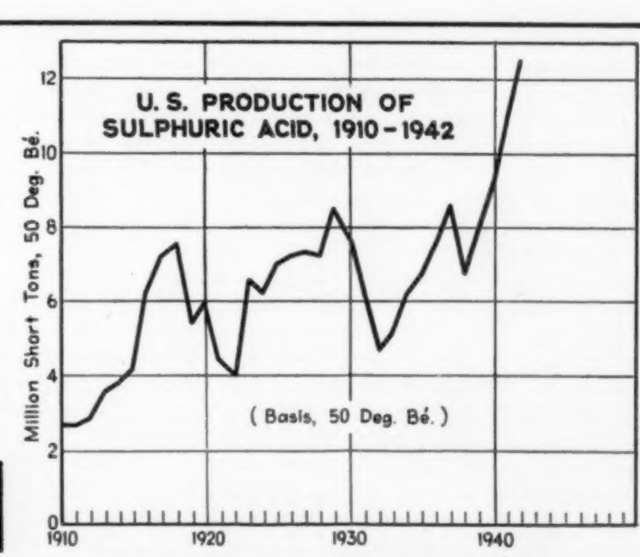
This was in spite of the fact that considerable new acid capacity was installed in 1942. In addition to new oleum towers and concentrators, which changed the character of the acid, if not the quantity, actual new capacity accounted for somewhere between 1,800 and 2,000 tons per day capacity on the 100 percent basis, the latter figure more than 1,000,000 tons annually of 50 deg. Bé. acid. Most of the new capacity was put in for munitions manufacture, and all of it for direct war use. The construction program has now been largely completed and relatively little new building is scheduled for 1943, except for a few plants for specialized application, as for example, for the regeneration of acid used in the sulphuric acid alkylation process for making high octane aviation gasoline.

Sulphuric acid production has increased every year since 1938 and is now far ahead of the previous peak years of 1929 and 1937. For 1942 we estimate a total sulphuric acid production of 12,520,000 tons, calculated as 50 deg. Bé., compared with 10,944,000 tons in 1941, 9,174,000 tons in 1940, and 8,209,000 tons in 1939. Consumption of sulphuric acid customarily runs close to production and is estimated to have been about 12,515,000 tons in 1942, 11,040,000 tons in 1941, 9,185,000 tons in 1940, and 8,030,000 tons in 1939. Although the production increase was neither the largest in tons or percentagewise that has taken place from one year to the next, it nevertheless amounted to more than 14 percent over 1941, with a slightly smaller percentage increase for consumption. Possibly a million tons more acid will be needed in 1943 than was taken in 1942. If so, we shall have a good demonstration of the extent to which practical capacity can be stretched toward the theoretical.

With only one exception, every major consuming outlet for acid increased its demands in 1942, which is made evident from the chart below and the table on the following page. Both in tonnage and percentagewise the largest increase was in our heading of "chemicals and defense" in which we have lumped direct military requirements, along with chemical uses, to conceal estimates of the former. If this figure cannot be discussed in detail, it can at least be stated that a considerable part of the increase came from larger chemical demand, as was true also in 1941. Also as in 1941, little spent acid from the nitration plants came on the market for use in fertilizers and pickling, which indicates that recovery operations were evidently considerably more efficient than had been anticipated.

Second in percentage increase was the fertilizer industry, which made more superphosphate than ever before to meet wartime requirements for greater soil productivity. In addition to greater demand for the production





Estimated Distribution of Sulphuric Acid Consumed in the United States

(Basis, 50 deg. Bé.)

Consuming Industries	1940 Short Tons (Revised)	1941 Short Tons (Revised)	1942 Short Tons
Fertilizers	2,260,000	2,500,000	2,950,000
Petroleum refining	1,260,000	1,400,000	1,650,000
Chemicals and defense*	1,120,000	1,790,000	2,250,000
Coal products	900,000	940,000	970,000
Iron and steel	1,300,000	1,500,000	1,600,000
Other metallurgical	640,000	800,000	840,000
Paints and pigments	580,000	700,000	760,000
Industrial explosives	170,000	190,000	195,000
Rayon and cellulose film	470,000	555,000	625,000
Textiles	125,000	165,000	145,000
Miscellaneous	360,000	500,000	530,000
Totals	9,185,000	11,040,000	12,515,000

* To avoid disclosing estimates of direct war applications of acid, such as in military explosives, this use of acid is lumped with chemicals in 1941 and 1942.

Data and Estimates on U. S. Sulphur Activity and Sulphuric Acid Production, 1940-1942

(Sulphur and pyrites in long tons; acid in short tons, 50 deg. Bé.)

	1940	1941 (Revised)	1942
Sulphur mined	2,732,088	3,150,000	3,500,000[1]
Sulphur exports	746,468	725,000	[2]
Domestic shipments	1,812,274[3]	2,675,000[4]	3,170,000[5]
Approx. mine stocks at end of year	4,200,000	3,925,000	4,255,000
Non-acid uses of sulphur	610,000	705,000	1,325,000[6]
Sulphur available for acid	1,230,119	1,970,000	1,845,000
Change in consumer stocks	+100,000	+500,000	+70,000
Acid from sulphur	5,882,000	7,580,000	9,150,000
Pyrites imports	407,004	310,000	[7]
Domestic pyrites	618,107	670,000	970,000[8]
Acid from pyrites	2,162,000	2,044,000	2,090,000
Acid from smelters	1,050,000	1,250,000	1,200,000
Acid from hydrogen sulphide	80,000	70,000	80,000
Total sulphuric acid made	9,174,000	10,944,000	12,520,000

[1]Includes about 3,460,000 long tons of sulphur mined on the Gulf Coast, plus western sulphur, recovery from fuel gases and sulphur imports from Trail, B.C., which are lumped to avoid disclosing estimate of imports. [2]Lumped with non-acid uses to avoid disclosing estimate of exports. [3]Does not include import of 27,774 tons from Trail, B.C., nor about 4,000 tons recovered from fuel gases. [4]Does not include import from Trail, B.C., nor sulphur from fuel gases, estimated to total about 31,000 tons. [5]Total shipments in 1942, including exports. [6]Includes sulphur exports. [7]Lumped with domestic pyrites consumption. [8]Includes estimated pyrites imports.

of the normal 18 percent grade of superphosphate, however, the industry also turned out more of the so-called "triple super" than at any time in the past, and did so largely with phosphoric acid made with sulphuric acid. Since practically all of the electric furnace phosphoric acid capacity had been diverted to phosphorus and food grade H_3PO_4 manufacture. Lend-lease requirements for the concentrated 45 percent triple super accounted in considerable part for the large increase in production of this material.

Another large increase in acid use was in petroleum refining which needed much more acid despite the decreased run to stills. Several factors were responsible for this situation as was noted in our review a year ago. Perhaps the more important was the sulphuric acid alkylation process which requires a great deal of acid for catalytic purposes, but does not degrade the acid seriously. In some refineries the acid, having passed through the alkylation process, can then be used for other

(*Please turn to page* 117)

Alkalis and Chlorine

Although 1942 saw little increase in caustic soda usage as compared with 1941, soda ash consumption increased by nearly 9 percent. The most striking factor was the continued growth of chlorine production which, owing to wartime demands, was expanded by almost one-third.

Except in the case of chlorine, production and consumption increases among the alkalis were not as large during 1942 as they were in the preceding year, but they were still substantial in most cases. The outstanding exception to this statement is the case of caustic soda distribution which, despite a considerable increase in production of this material, registered only a minor rise in 1942, with the result that the increase in stocks held at the end of the year was greater than the industry likes to see. Wartime demands for chlorine were the high point of the alkali year, requiring an output that was almost one-third over that of 1941. The result was a large increase in the production of electrolytic caustic soda. Coupled with a slight increase in the causticizing of soda ash, this pushed total caustic production to a new peak about 18 percent above the previous high in 1941. With only a slight rise in caustic consumption, nearly the entire production increase was added to stocks.

A much better stock situation occurred in the case of soda ash. Here production rose about 8 percent, matched by use of this chemical in slightly greater proportion compared with the preceding year. Soda production facilities were evidently taxed, and what little capacity increase was added during the year was required in making up the new total. The industry has customarily operated at about 80 percent of its total capacity, but not all of this can be used at any one time, to allow outage for maintenance and repairs, while not all of the rated capacity is modern. It would appear therefore that the actual output was close to the practical working capacity of the industry, if not slightly in excess of it.

Our estimate of the output of soda ash at ammonia soda plants is approximately 3,800,000 tons in 1942, compared with 3,520,000 tons in 1941 and 3,015,000 tons in 1940. Natural soda plants also operated close to capacity, with an output of about 140,000 tons in 1942, compared with probably 130,000 tons in 1941 and 120,000 tons in 1940. The third source of soda ash, the electrolytic soda cells of one large pulp manufacturer, probably produced about 18,000 tons in 1942 and 1941, with possibly 22,000 tons output in 1940. These figures then total for the three years 3,960,000 tons in 1942, 3,668,000 tons in 1941 and 3,157,000 tons in 1940.

As indicated in the accompanying

Production of Caustic Soda in the United States

(Short Tons)

Year*	Lime-Soda	Electrolytic	Total
1921	163,044	75,547	238,591
1923	314,195	122,424	436,619
1925	355,783	141,478	497,261
1927	387,235	186,182	573,417
1929	524,985	236,807	761,792
1931	455,832	203,057	658,887
1933	439,363	247,620	686,983
1935	436,980	322,401	759,381
1937	488,807	479,919	968,726
1939	530,907†	494,104†	1,025,011
1940 (estimated)	505,000	595,000	1,100,000
1941 (estimated)	600,000	700,000	1,300,000
1942 (estimated)	625,000	910,000	1,535,000

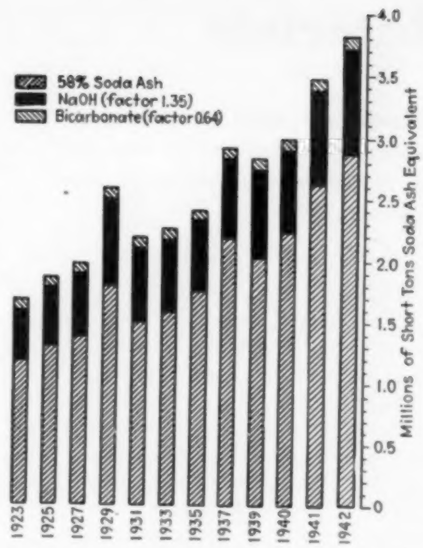
* Figures for 1921–1939 are from the U. S. Bureau of the Census. Electrolytic caustic soda figures do not include that made and consumed at wood-pulp mills, estimated at about 30,000 tons in 1927 and 1929, at about 24,000 tons in 1931, 21,000 tons in 1933, 20,000 tons in 1934, 17,000 tons in 1935, 19,000 tons in 1936 and 1937, 18,000 tons in 1938, 25,000 tons in 1939, 30,000 tons in 1940, 30,000 tons in 1941 and 30,000 tons in 1942.

† Estimated. 1939 Census gives 523,907 tons of lime sodr caustic and 426,250 tons of electrolytic caustic made for sale. The total of 74,854 tons made and consumed is not distributed by process. We estimate 7,000 tons of lime soda caustic made and consumed.

tabulation, our studies of soda ash consumption show a close correspondence between the increases in production and consumption. Total soda ash usage is estimated at 3,944,000 tons in 1942, compared with 3,623,000 tons in 1941 and 3,126,000 tons in 1940. Sales of soda ash as such also increased in about the same ratio, with estimated sales of 3,017,000 tons in 1942, 2,740,000 tons in 1941 and 2,377,000 tons in 1940.

As for caustic soda, our estimates show a production of 625,000 tons of lime-soda caustic, plus 940,000 tons of electrolytic NaOH, or a total of 1,565,000 tons (including the 30,000 tons made and consumed at pulp plants which is mentioned in the footnote of the tabulation on the preceding page). This compares with lime-soda production estimated at 600,000 tons in 1941 and 505,000 tons in 1940; and with electrolytic caustic soda production of 730,000 tons in 1941 and 625,000 tons in 1940. The percentage of caustic soda made electrolytically has obviously been rising continuously, in 1942 reaching 60 percent of the total.

Caustic soda production illustrates what has happened to the chlorine picture. Chlorine production in 1942 is believed to have topped slightly 1,000,000 tons, compared with a total of 775,000 tons in 1941 and 635,000 tons in 1940. Of the 1942 production of this essential raw material, probably more than 850,000 tons was produced coincident with NaOH, and more than 150,000 tons by other processes, including the manufacture of metallic sodium, caustic potash and electrolytic soda ash, and by the nitrosyl chloride process, capacity of which was doubled in 1942.



Production for sale of principal ammonia soda products (ash equivalents)

Aside from the general rise in consumption of the alkalis which occurred in several consuming quarters, there are a number of special points that should be noted. Glass production increased materially, owing to the sharp rise in container manufacture, which more than offset losses in plate and window glass. The soap industry was less active than in the earlier year, adversely affecting both soda and caustic, a fact which is also true of petroleum refining and pulp and paper. Continued large increase in rayon manufacture was of course reflected in the caustic soda picture, while in soda ash usage a factor now becoming so important that it has been given a separate listing in our tabulation is the consumption in non-ferrous metals production. More than 70 percent of the 260,000 tons estimated to have been so used went into the refining of bauxite for the enormously expanded aluminum industry.

Estimated Distribution of Soda Ash Consumed in the United States

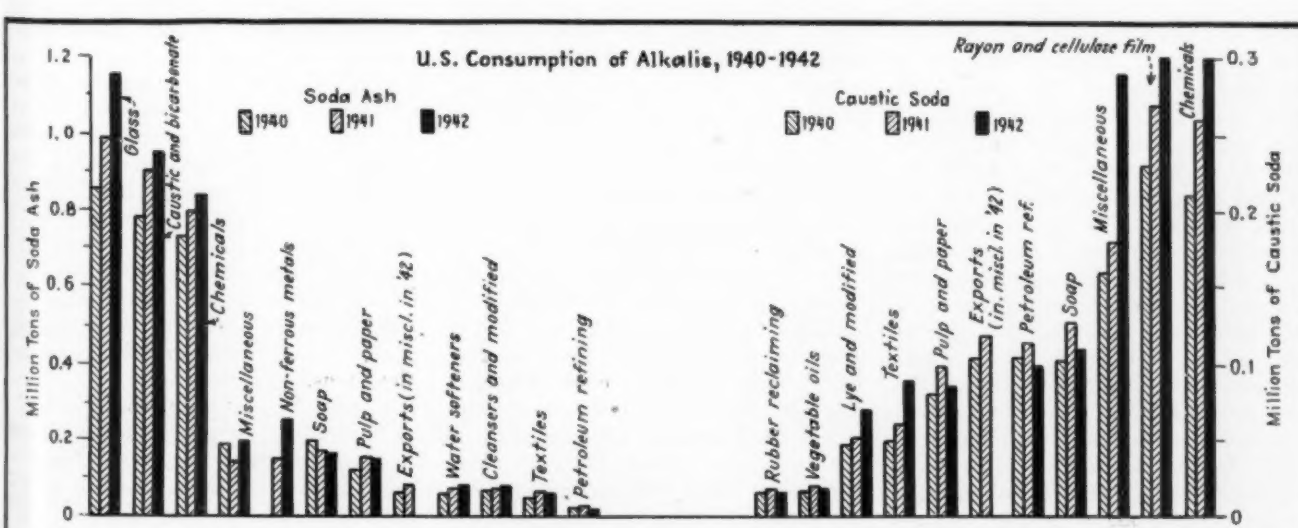
Consuming Industries	1940 Short Tons (Revised)	1941 Short Tons (Revised)	1942 Short Tons
Glass	860,000	990,000	1,150,000
Soap	200,000	170,000	165,000
Caustic and bicarbonate	780,000	910,000	950,000
Other chemicals	730,000	800,000	840,000
Cleansers and modified sodas	65,000	70,000	80,000
Pulp and paper	123,000	155,000	145,000
Water softeners	55,000	70,000	80,000
Petroleum refining	20,000	23,000	18,000
Textiles	45,000	60,000	56,000
Non-ferrous metals	[1]	150,000	260,000
Exports	58,000	85,000	[1]
Miscellaneous	190,000	140,000	200,000
Totals	3,126,000	3,623,000	3,944,000

[1] Included in miscellaneous.

Estimated Distribution of Caustic Soda Consumed in the United States

Consuming Industries	1940 Short Tons (Revised)	1941 Short Tons (Revised)	1942 Short Tons
Soap	103,000	125,000	110,000
Chemicals	212,000	260,000	300,000
Petroleum refining	105,000	116,000	100,000
Rayon, staple fiber and cellulose film	230,000	270,000	300,000
Lye and cleansers	48,000	52,000	70,000
Textiles	48,000	63,000	90,000
Rubber reclaiming	15,000	18,000	15,000
Vegetable oils	16,000	20,000	19,000
Pulp and paper	78,000	100,000	85,000
Exports	105,000	120,000	[1]
Miscellaneous	158,000	180,000	290,000
Totals	1,118,000	1,324,000	1,379,000

[1] Included in miscellaneous.



U.S. Consumption of Alkalis, 1940-1942

Fertilizers and Materials

Manufacture of potash salts, superphosphate, and mixed fertilizers made all-time high records last year. Consumption of fertilizer nitrogen was less than a record because of military needs. Requirements of food in unprecedented quantity presage still higher demands in 1943.

MANUFACTURE and sale of fertilizer during 1942 made an all-time record as to tonnage of goods and as to tonnage of contained plant food. Nearly 9.5 million tons of mixed fertilizers and fertilizer materials were sold by the industry in the United States. This represents an increase of nearly 5 percent in tonnage over 1941. The plant food contained probably increased by the same percentage, since increases in concentration of certain plant foods were offset during the latter part of the year by limits on nitrogen content.

The prices charged for fertilizer last year were slightly greater than the preceding year. Establishment of price ceilings by O.P.A. has, of course, prevented any large shift upward. The major causes of rise of prices were the increase in the cost to the industry of natural organic materials and increased freight, especially as rail haul replaced water movement. The cost of chemical nitrogen and potash remained unchanged during the year, a fact of great credit to the chemical producers. These price relationships as estimated by the National Fertilizer Association in its fertilizer price indexes are clearly shown, as follows:

	Dec. 1942	Dec. 1941
Mixed Fertilizers......	115.3	112.7
Fertilizer Materials:		
All Materials........	117.5	115.0
All Nitrogenates	116.2	113.8
Natural Organic..	137.3	129.0
Chemical	109.3	109.3
Phosphates	116.4	112.5
Potash Salts.........	111.0	111.0

Materials for manufacture of mixed fertilizer were abundant last year, and will be in 1943, except in the case of nitrogen materials. The fear which arose early in 1942 as to sulphuric acid supply later proved unfounded. The Army has taken huge quantities of acid for explosives making and for other purposes. But at no time has there been any significant shortage, even locally, for the superphosphate maker. Careful review of the acid situation at the beginning of January lead to an assurance from official sources to the industry that even the new demands for acid for aviation gasoline manufacture would not seriously deplete the wanted supplies at fertilizer works. The situation with respect to phosphates, potash, and nitrogen, is discussed separately in the sections of this article which follow.

For many years the fertilizer industry has sought to establish standard grades for mixed fertilizers. This program was greatly accelerated by official participation during the last six months of 1942. Spokesmen from agriculture and representatives of the industry met in all parts of the country and drafted recommendations as to the most desirable grades for mixed fertilizers for each area. The results were considered officially and a set of required "grade standards" was established. The entire industry is, therefore, now conforming to a program based on simplified manufacture. One result is expected to be a substantial economy because of the fewer grades marketed in any given area.

A second part of this program provided that less nitrogen be used on certain crops. This result was, in fact, the primary motive of the Government in organizing and carrying through this program. It is expected that on the average the chemical nitrogen content of mixed fertilizers will now be definitely lower than last year, perhaps by 20 percent. Fertilizers of high nitrogen content will still be available for those crops for which they are most necessary. But luxury crops like melons and cucumbers will not receive any fertilizer containing chemical nitrogen.

Total farm income from 1942 crops was very high. This fact implies that 1943 purchases of fertilizer are likely to set another all-time high record. When the farmer has cash available from his preceding crops he is almost certain to buy fertilizer generously in the hope of raising another big crop. Crop goals for agriculture in 1943 also demand the maximum effort of farmers with the aid of the maximum available quantity of fertilizer. Shortage of farm labor can be partly offset by more use of plant food on the farm. All this means that heavy government influence and manpower shortage both tend to increase fertilizer demand. As a consequence, it has been estimated by F. W. Parker, chief of the fertilizer investigations of the bureau of Plant Industry, that there may be a demand during 1943 for somewhat more fertilizer than the industry can produce. Industry spokesmen seem to believe that there will be no large deficit in supply. On the basis that there will be enough needed fertilizer, Secretary Wickard, under authority from WPB to issue allocation orders, has instituted an allocation program to assure that "A" crops receive adequate supplies. Among the crops which have been put in the "A" class are long-staple cotton, castor beans, peanuts, soybeans, fiber and seed flax.

POTASH

Deliveries of potash by American producers during 1942 again established a new record. They supplied approximately 585,000 tons of K_2O for agriculture and about 65,000 tons for chemical and related industrial uses. The total of 650,000 tons of potash represents consumption at an all-time high for both agricultural and industrial purposes.

During 1943 still greater production and use are expected. A 10 percent increase in demand for agriculture is expected by domestic potash producers. Chemical usage also is likely to increase by nearly the same percentage.

Notable in recent developments has been the domestic production of potash chemicals for special uses. United States industries are now supplied almost exclusively with chlorate, nitrate, caustic and other such chemicals from producing plants within the U. S. Further expansion of these plants is continuing with the prospect that 1943 will establish almost complete self-sufficiency despite greatly increased demands.

PHOSPHATES

Production of phosphate rock, manufacture superphosphate, and consumption of superphosphate in fertilizers all made new records in 1942.

Superphosphate manufacture during the last calendar year (1942) provided about 5.1 million short tons of superphosphate, when calculated as 18 percent P_2O_5. The actual production for sale was on the basis principally of 18, 19, and 20-percent goods; but for statistic purposes all is calculated to the 18 percent base. During 1942 the production of triple superphosphate was approximately 300,000 tons of 45-percent goods. Calculated on the 18 percent base, this triple superphosphate amounted to 750,000 equivalent tons.

During the past year relatively little production of triple superphosphate was carried out at the electric furnace plants. All of these, including the plant of T.V.A., were engaged primarily on the manufacture of elemen-

tal phosphorus and of phosphoric acid for use in chemical work. However, T.V.A. did make some "triple super" which went principally to England through Lend-Lease channels.

In previous years the government had used a great deal of triple superphosphate in its Soil Conservation program. During the past year, however, almost none of this concentrated material was employed. This distribution was of 18 to 20-percent goods and amounted to approximately a million tons on the 16 percent base. (Note that the government use is calculated on a different base than the commercial production.) Approximately one-third of the total "triple super" made was exported, the other two-thirds went into normal commercial channels in the United States.

Preliminary estimates indicate that for manufacture of superphosphate of all grades about 3 million tons of phosphate rock were required. Nearly 2 million tons more were used to make phosphoric acid or elemental phosphorus in electric furnaces, for export, or for special applications, including ground rock for use as a fertilizer. The usual detailed breakdown of these figures cannot be presented as statistics on acid and phosphorus are subject to military restriction.

NITROGEN

Nitrogen supply for fertilizer usage probably dropped off slightly last year as compared with 1941. Military need for ammonia with which to make explosives was the major cause of this shift. Official figures have been released on "fertilizer nitrogen supplies for U. S. consumption" in a report by Mr. F. W. Parker, chief of the fertilizer investigations of the U. S. Bureau of Plant Industry.

Since Mr. Parker presented his summary to National Fertilizer Association he has made the following qualification: "Since this estimate of nitrogen supplies for 1942-43 was prepared, the outlook for supplies of chemical nitrogen for fertilizers has materially improved. If imports of Chilean nitrate of soda are maintained, nitrogen supplies for the 1943 season will be very satisfactory—much better than seemed possible a few months ago." It should be noted that even after that qualification was made, another change in the situation for next year occurred through the withdrawal of certain oil-seed meals from fertilizer use.

During 1943 there was a record crop of oil seeds, especially peanuts and soybeans. As a result of crushing for oil, there resulted a record supply of high-protein meal. For a time it was expected that much of this would be used to supply organic nitrogen for fertilizers. But the prospective shortage of feed has made it necessary to forbid the use of the meal in fertilizers.

Production of synthetic ammonia at privately owned and Government plants made an all-time record last year. Still larger production is certain in 1943. Peak production will be reached before mid-year unless new military programs are imposed.

Imports of nitrogen materials continued last year at a substantial rate, contrary to expectation. Cyanamide and synthetic products from Trail, B. C. thus contributed materially to United States needs. Also the import of Chilean nitrate was much greater than anticipated during the early days of shortage of shipping space. It is hoped that 1943 will experience a continuation of these favorable conditions in nitrogen supply from abroad.

Potash Supplies, 1942-43

(Tons of K_2O Equivalent)

Chemical potash [1]	630,000
Miscellaneous sources [2]	15,000
Total	645,000

Potash Requirements, 1942.43

(Tons of K_2O Equivalent)

As fertilizer mixed goods [3]	402,000
As fertilizer materials [4]	74,000
As fertilizer, AAA contracts	14,000
Hawaii	10,000
Puerto Rico	12,000
Total U. S. agriculture	512,000
Total U. S. chemical [5]	65,000
Total U. S. requirements	577,000
Apparent balance	68,000
Export commitments	
Canada	34,000
Cuba	3,500
Quotas other American Republics 1942 basis	3,000
Total export commitments	40,500
Apparent net surplus [6]	27.500

[1] Production capacity, refined salts. Estimate 100% over-all efficiency in operation. [2] Production capacity estimates based on 1941 figures. Includes vegetable potash, hull ash, oilseed meals, etc. [3] Preliminary estimates based upon 1942-43 approved grades by states and 1941 tonnage of commercial mixed fertilizers. [4] based on 1939 figures in N.F.A. Survey adjusted to 1942-43 conditions. [5] Estimates furnished by War Agencies. [6] Run-of-mines sales excluded; probably 40,000 tons of crude salts will be utilized in 1942-43.

Nitrogen Supplies, 1942-43

(Tons of N)

Stocks on hand 7/1/42	15,000
U. S. Production for agriculture	
Ammonium sulphate	154,000
Other chemicals	26,000
Customary organics	50,000
Imports	
Canada	25,000
Chile	160,000
Total supply	430,000
Less exports from U. S.	
Lend-lease commitments	7,000
Spanish	2,500
Expected to Latin Americas	7,000
Sodium nitrate to Canada	3,500
Total exports	20,000
Net supply for U. S. Agriculture	410,000

Nitrogen Requirements, 1942-43

(Tons of N)

Continental U. S.	426,000
Hawaii and Puerto Rico	36,000
Working stocks (carryover)	
For mixed goods	8,000
For straight materials	12,000
Total requirements	482,000
Less savings by governmental action	40,000
Net requirements	442,000
Net deficit	32,000
Nitrogen obtained by diversion of 500,000 tons oilseed meals	35,000

Phosphorus Supplies, 1942-43

(Tons of P_2O_5)

Production capacity of operating plants	
Ordinary superphosphate [1]	1,517,000
Triple superphosphate [2]	145,000
Other phosphate for fertilizer [3]	50,000
Total production capacity	1,712,000

Phosphorus Requirements, 1942-43

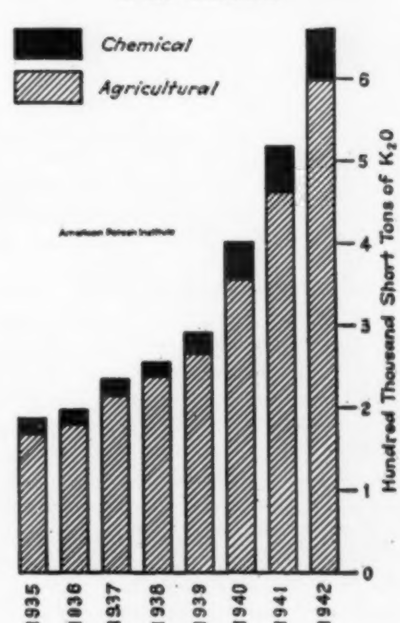
(Tons of P_2O_5)

Continental United States	
Ordinary superphosphate	883,000
Triple superphosphate	63,000
Other phosphate for fertilizer	38,000
Hawaii and Puerto Rico	
Ordinary superphosphate	16,000
Total U. S. requirements	1,000,000
Total superphosphate available for United Kingdom	82,000

[1] Maximum capacity of operating plants. [2] Production of triple superphosphate with facilities now in operation. [3] Bone meal, animal tankage, fish scrap, etc.

Potash Deliveries by U. S. Companies

Data From American Potash Institute for Deliveries to United States, Canada, Cuba, Porto Rico, and Hawaii, in Thousands of Short Tons of K_2O Contained.



Plastics

The industry has been built on a foundation of a large number of small uses. Recent developments indicate that this stage is coming to a close. Postwar applications requiring large volumes will overshadow the small outlets adding greatly to the stature of the plastics industry.

THERE ARE PROBABLY more unqualified predictions made about the future of plastics than about any other American industry. Much of this enthusiasm is justified. The industry grew and fanned out rapidly before Pearl Harbor Day but the responsibility placed in it by the needs of the armed forces has acted as a strong stimulant to further development.

The war has brought about an enormous expansion in the production of such raw materials as styrene and phenol, and in most of the finished plastics, particularly polyvinyl chloride and acrylic resins. These developments already have brought about reduction in the price of some materials and others are certain to follow when the government withdraws from the market. Lower prices for plastics should greatly stimulate their use.

Of the large number of new uses developed for plastics in the several branches of the armed forces, it is recognized that some will disappear with the war but it is also quite certain that many will be retained and become permanent outlets. Much has been learned in projecting the use of plastics in new applications and a great deal of data have been assembled on the characteristics of these materials.

The industry has been built on a foundation of a large number of applications calling for comparatively small amounts of plastics. Recent developments indicate that this stage in the life of the industry is coming to an end. After the war uses requiring large volumes of the materials will overshadow the small outlets adding greatly to the stature of the plastics industry.

Resin impregnated plywood is now being widely developed. This low cost material can be molded into forms suitable for the construction of airplanes, boats and furniture. The plywood furniture will probably be followed by molded plastic furniture. The all-plastic automobile body placed on exhibit shortly before the war may be the first of many such automobile bodies. Certainly the postwar car will contain many structural parts in addition to the gadgets made of solid or laminated plastics, or plywood in which synthetic resin is the bonding agent. Housing is another field in which plastics will have an important role in the future. Plywood prefabricated houses are being used extensively for putting up defense communities. This development will provide the groundwork and experience for inexpensive postwar housing.

The plastics industry as a whole has gone ahead tremendously during the past year. In most cases the applications are limited to military and essential civilian needs. While some further expansion is being made it will not be very large due to restrictions on use of raw materials and equipment.

CELLULOSE PLASTICS

In the first six months of the year there was a very large increase in the production of cellulose acetate molding powders (acetate and acetate-butyrate). The Department of Commerce reported a production rate of about 24,000,000 lb. per yr. during the first months which compares with 15,600,000 lb. for the corresponding period in 1941. While figures are not available for the balance of the year it is known that this plastic continued to be made in large volume, and is one of the most available thermoplastics. A limiting factor has been the availability of acetic anhydride. Because of this shortage there has not been sufficient cellulose acetate to meet all the permitted uses, according to Ralph H. Ball, chief of Organic Plastics and Resins Sections of WPB.

Acetate plastic has not been accepted for universal use by the army and navy. However, it has been adopted for many important applications. A civilian use of interest is in shatterproof windows for factories and other places where danger from shattering glass exists. Blue tinted film is being used in store windows on the Board Walk at Atlantic City and in other dimout areas. It is used as a substitute for metal in door knobs, draw pulls, vacuum cleaner parts, faucet handles, and so forth. Its use in X-ray film is also important.

Cellulose acetate butyrate in the form of sheets, rods, tubes and special shapes has increased somewhat during recent months. The rate now is double what it was in the first six months of 1942. Ball reported that there has been periods of shortage when the volume of war uses increased to the point where supplies for civilian use were highly curtailed. This situation was met by plant rearrangements to increase the output, which, coupled with a small civilian demand for molded parts, has again resulted in a free supply.

Cellulose acetate proprionate was made in small quantities. Therefore, the entire output of this plastic was available only for important war applications.

In the last few months of the year nitrocellulose production encountered trouble when it was curtailed by a shortage of nitric acid. Sheets, rods and tubes in the first half of the year amounted to 8,513,000 lb., which is about the same rate as in the previous year. During the year more and more of the production had to be shifted from cotton linters to wood pulp. This plastic was used for military purposes in the form of a surface coating, and as a molded plastic.

Ethyl cellulose was in increasing demand throughout the year for war purposes. In fact, the war requirements put an end to civilian uses. It has been predicted that in the future the military demand will outstrip the supply. Two new ethyl cellulose plastics were announced recently; ethyl rubber resembles natural rubber because of its elasticity and flexibility. It is a product of the Hercules Powder Co. This material can be used in place of natural rubber for numerous military and civilian purposes. The other new variety of ethyl cellulose has particularly good impact resistance and toughness of injection moldings at low temperatures. It has proved useful in making tubing and compression fittings.

Ethyl cellulose coatings are in demand because of their toughness over a wide temperature range. This cellulose compound is used as a lacquer for protecting rubber coated cables, for impregnating or coating fabrics and other uses. Hercules produces the material from which a plastic can be made and Dow offers an ethyl cellulose molding plastic.

ACRYLIC RESINS

Acrylic resins are produced by du Pont and Rohm and Haas. Production has been increased several fold in recent years, nevertheless further increases are essential to the war effort. At the present time plans are going

forward for an expansion of monomer capacity to about 140 percent of 1942 production and in sheet capacity to about 300 percent. These new facilities are scheduled for completion in the summer. It is expected that the enlarged production will meet all important military requirements, but will not permit its use by civilians.

VINYL RESINS

Vinyl resins were hailed by the Baruch Committee as a substitute for rubber, saving the equivalent of 22,000 tons of crude rubber a year. The WPB placed them under allocation because, despite large increases in production capacity there are not enough to satisfy all military requirements. This group of resins has now probably passed the cellulose plastics in volume produced. Last year production was considerably more than twice as large as it was in 1941. It is expected that in 1943 a further increase will be made by improved methods of production and more efficient use of present equipment.

There are two major producers of vinyl acetate monomer. This intermediate material is being used first to maintain full production of chloride-acetate copolymer, polyvinyl formal and polyvinyl butyral, with the small amount left over going to polyvinyl alcohol and polyvinyl acetate. It is estimated that the requirements for acetate monomer in March will be about 200 percent of the production capacity. An expansion in capacity is underway and it appears that there will be facilities available by July in an amount equal to 180 percent of the present production capacity.

Approximately 43 percent of the present vinyl acetate production is being diverted to the making of acetal resins. About 7 percent of current production goes to the manufacture of sulpha drugs. As much as 14 percent of the acetate is being used in the making of vinyl chloride copolymers.

Carbide and Carbon Chemicals Corp. is a leading producer of polyvinyl chloride and its copolymers. E. I. du Pont de Nemours & Co. and Shawinigan Resins Corp. together with Carbide and Carbon, produced the polyvinyl butyral consumed in automobiles as safety glass before the war. Now the demands are principally military safety glass and such coated fabrics as raincoats. Production is at capacity, but there is insufficient supply to meet war needs. An important reduction was made in the price of the butyral from \$1.25 per lb. prevailing in 1941 to 85c. per lb. in 1942.

There are four major producers of polyvinyl acetate. There is not enough of the raw material for the producer to operate at capacity. Three of these companies make straight polyvinyl acetate resins which are used mainly for adhesives. It is expected that production will be reduced materially because of raw material shortage.

Polyvinyl alcohol is made by du Pont. The resin enters into the production of direct war products such as linings, solvent-resisting tubing, textile finish, and films.

Polyvinyl chloride and vinyl chloride copolymers are the most important of the vinyl group in the war effort. It is estimated by Frank Carmen, head of Plastics and Synthetic Rubber Section of WPB, that 12,000,000 lb. of these resins were used as rubber substitutes during the first six months of 1942. These resins may be divided into two classes: one covers polymers containing 92 percent or more of vinyl chloride, and the other those resins with less than 92 percent. The production capacity of the high molecular weight resin reached an annual rate of 36,000,000 lb. per yr. in December. Production capacity of the lower type is about 25 percent as large. Polyvinyl chloride resins are made by B. F. Goodrich, and Carbide and Carbon.

Approximate prices for the vinyl resins in carload lots are as follows: vinyl chloride-acetate, 48c. per lb.; vinyl acetate, 40c. per lb.; vinyl chloride 48c. per lb.

Vinylidene chloride plastics were introduced in 1940 by Dow Chemical Co. Their outstanding characteristics are chemical resistance, high tensile strength, and toughness. They have a wide transparent color range. Molded fittings and extruded tubings are serving in place of copper and brass. Thick walled pipe takes the place of hard rubber. Woven and braided fabrics have developed rapidly.

UREA-FORMALDEHYDE

Among the principal producers of urea formaldehyde resins are Plaskon Corp., American Cyanamid Co., Bakelite Co. and Rohm and Haas. The smaller demand for civilian goods caused by shutting down household appliance and electrical goods manufacture has decreased the output of urea molding plastics well below peacetime levels. However, by the time the army is supplied with buttons and further replacements of phenolic resins by urea molding resins has taken place in essential civilian products, this production is expected to recover. At the year end the industry was operating at 90 percent capacity. The adhesive resins unlike the molding compounds have already found wide use for war purposes, especially for plywood manufacture.

There is a growing demand for the American Cyanamid's melamine-formaldehyde resins which now indicates this new material might possibly be restricted to necessary military items in the field of insulation. The Quartermaster Corps has approved this resin for buttons on cotton garments issued to the army personnel, based on the resistance of the resin to laundering, decontamination and other severe conditions required by this service. Due to limited capacity for the production of melamine a few large volume uses can convert the resin situation from one of free supply to severe shortage almost over night.

Due to a shortage of phenol, cresol and cresylic acid the production of the phenolic resins have been limited. Only military uses and the most indispensable civilian needs are being met. Carmen has stated that during the month of September approximately 48 percent of the total phenol production was diverted to resin manufacture; of the total demands for phenolic resins for the same month, only 60 percent were satisfied. Extensive expansions are being made in the phenol manufacturing capacity and it is expected that the rate of production during the latter part of 1943 will be 175 percent of the present rate. It is expected that the 1943 demand for phenolic resins will be 120 percent of the present over-all requirements, and as already indicated this is being satisfied to the extent of only 60 percent. Of the phenolic resins 80 percent are consumed in direct war uses, 13 percent in indirect and 7 percent in essential war uses.

Since styrene production was ahead of the butadiene and copolymer rubber plants substantial volumes were available for converting into polystyrene resins throughout the year. At the present time about one-half of the monomer production is going into resins for war purposes. This will be greatly reduced when it is required for the rubber program. In October, one company announced a one-third reduction in the base price of the resin, from 45c. to 30c. per lb.

Among the promising new materials should be mentioned C-39 of Columbia Chemicals Division of Pittsburgh Plate Glass Co., allyl phthalate of Shell Development Corp. which is said to be superior as an interior lacquer for cans, and General Electric's as yet unnamed clear transparent thermoplastic product. Du Pont will have available molding compositions of the nylon type.

Natural and Synthetic Rubber

No doubt many an hour of sleep is being lost in an effort to determine the course of the billion dollar American synthetic rubber industry in the decade following the signing of an armistice. Here are just a few of the factors that must be weighed in arriving at a decision.

The United States is assured of a synthetic rubber industry with a production capacity much greater than the 600,000 ton prewar consumption of natural rubber. The goal of 1,000,000 tons should be reached sometime next year. What is to become of this great new industry which has been referred to as the outstanding achievement of all time of the American chemical engineer? Will the federal government's $1,000,000,000 investment in butadiene, styrene, copolymer plants be charged off to the war effort and the plants permitted to go to rack and ruin when natural rubber again becomes available in large volume?

Many factors will influence the future of the American synthetic rubber industry. Assuming that European interests again get control of the natural rubber supplies of the Far East at what price will they be able to deliver rubber to the American market? How long a time after peace has returned in the Pacific will be required to restore the plantations of the Dutch East Indies and elsewhere and get shipments to this country? At what cost per pound can synthetic rubber be made when the plants are operating at capacity and the chemical engineers have had a year or two of peace-time conditions to improve the operating efficiency? How will the synthetic rubber automobile tires, inner tubes, and the thousand and one other rubber articles compare with similar items made of natural rubber? Will the government at Washington put a tariff on rubber to protect the new industry that has become so vital to the defense of this country? At a time when every effort is being made to prevent unemployment will the government destroy an industry giving employment to 150,000 men and women?

Another influence that may make itself felt in a few years is the Brazilian and other South American natural rubber that this government is now encouraging. What of the influence of guayule? Many other factors might be mentioned.

Before the war Europeans had strict control over prices of crude rubber. Our industries paid on the average 12.85c. per lb. during the decade before the war. The average for those years ranged between 3.44c. and 20.55c. per lb. However, it is generally believed that natural rubber can be delivered here at a price below the average for the decade, and might be after the war in order to destroy the competition offered by synthetic rubber.

At what prices the synthetic rubber industry will be able to sell its products and yet make a return on its investment remains to be seen. Much will depend on capacity operations which will not be reached for another six months or a year. In August, 1941, synthetic rubber sold at a price range from 45c. to 70c. per lb. In July, 1942, the late W. S. Farish, president of Standard Oil Co. of New Jersey, stated that improvements in processing were expected to reduce plant investment to $350 a ton of annual capacity from $750 and to make an approximate reduction of 5c. per lb. in the cost of making butyl rubber. Under the new program he estimated that the cost would be between 10 and 15c. a lb. at capacity operation, including the amortization of the plants within five years.

It would be unfair to use these cost figures of butyl rubber as a yardstick for all varieties of synthetic rubber for the raw materials from which the several types are made and the processes are different. However, the Standard Oil estimates on cost of butyl should give some idea of the higher costs of Buna S, Buna N, and the other materials that may prevail in postwar times.

When natural rubber becomes available again in large quantities it will be found that the synthetic materials have secured a strangle hold on the industry that will not be simple to remove. For numerous applications the synthetic rubbers are superior to the natural. The substitute materials also have made possible the production of many articles that could not have been made from the natural product. It will be found that synthetic rubber has brought about an entirely new field of rubber manufacturing that should prosper under more normal conditions.

The history of the development of rubber substitutes shows clearly the trend toward "tailor made" or special purpose synthetics rather than toward a general replacement for natural rubber, as has been stated by F. M. Andrews, Hyear Chemical Co., (*Petroleum Refiner*, Vol. 21, No. 10, p. 170). Although no one rubber substitute possesses all of the properties of crude rubber, the use of special purpose synthetic rubbers will enable the rubber compounder to duplicate practically any of the properties of natural rubber and in many cases surpass them.

Natural rubber compounds are somewhat superior in elasticity, rebound and extensibility. However, for resistance to the action of solvents, oils, fats, and greases, resistance to deterioration by heat and to the action of air, for resistance to aging in storage and sunlight and to many chemicals, for low water absorption, and low permeability to gases, synthetic rubbers are supreme. It is for applications involving these properties that synthetics have displaced natural rubber thus establishing a field for themselves.

Accumulated Annual Capacities of Synthetic Rubber Plants by Quarters for Buna S, Butyl, Neoprene and Thiokol

(Includes neoprene and Thiokol capacities of private plants)

1943	1st Quarter	2nd Quarter	3rd Quarter	4th Quarter
Buna S...	300,000	495,000	645,000	705,000
Butyl....	24,000	75,000	132,000	132,000
Neoprene.	18,700	28,700	28,700	68,700
Thiokol...	24,490	60,490	60,490	60,490
Total.....	367190	659,190	866,190	966,190

Data Col. Bradley Dewey, deputy rubber director, presented to Senator Gillett's rubber investigating committee Dec. 10, 1942

By capitalizing their superior qualities for specialty purposes, notwithstanding their higher costs, a business was built up in the last decade in two rubber-like materials, Thiokol and neoprene. Thiokol, which is currently selling as low as 35c. per lb., is particularly valuable because of its resistance to solvents. It has been used for hose, packings, and so forth. A new type of Thiokol introduced in 1942 can be used for re-treading tires. The present government program includes plants with a capacity of 51,000 tons a year.

Neoprene has remarkable resistance to aging and to deterioration by oils, gasoline, sunlight, heat and many chemicals. Its characteristics are close to those of natural rubber. It is being used for applications around gasoline stations and petroleum refineries, and general mechanical goods. For these purposes it is superior to natural rubber.

The remarkable resistance of butyl rubber to oxygen, tear and abrasion has resulted in the construction of plants to make it which will have a total capacity of 132,000 tons a year. While butyl rubber is not so good as Buna S or natural rubber for automobile tires, Farish said that for many

items it is superior to natural rubber. He explained that inner tubes and gas bags for blimps made out of butyl hold air or gas much better than when made from natural rubber. In addition, there are a number of items, such as hot water bags, boots and shoes which will last longer when made from butyl.

In the government's program for a synthetic rubber industry emphasis has been put on Buna S because of its proved suitability for tires, relative cost, plentiful source of raw materials and industry experience. The Rubber Reserve Corp. has authorized the building of plants with a capacity of 705,000 tons of Buna S yearly.

The extensive experience in the use of the synthetic rubber will be useful when peace returns and it becomes possible to seek other outlets. One authority has predicted that the automobile tire and inner tube will consume much of the synthetic material. He believes that such tires eventually will evolve with a life of at least 100,000 miles. Andrews states that these new materials will be used for brake linings for automobiles, linings that will withstand higher temperatures and will therefore be far more effective. Bearing and clutch facings that can operate in oil are a definite possibility and as are numerous other uses. Yet the automobile industry will merely scratch the surface of the synthetic rubber applications.

Added to these uses will be wire insulation where oil resistance is a factor such as in cables around transformers, in motor ignition-cable coverings and in welding equipment. Other uses will include synthetic rubber oil and gasoline shiploading hose, refinery bulk-loading hoses, filling-station hose, paint and lacquer hose. Further expansion is possible in the use of conveyor belting for carrying coal, coke, minerals and other materials that would deteriorate belting of natural rubber. Hard rubber made from the new materials is definitely superior. It can be more easily machined and polished and has a much higher softening point. A synthetic rubber with excellent electric characteristics is already in use. The printing industry discovered the advantages of synthetic rubber printing rollers. These are but a few of the many, many uses to which synthetic rubbers can be put when they are available for civilian purposes. Products that have never been made of rubber may very well be produced of the synthetic material in postwar times.

With the resumption of normal activities much of the development and research now directed along war uses will be put into play to promote the peacetime utilization of these new materials, and it will be difficult, if not impossible, even to estimate the many varied synthetic rubber products that will then result.

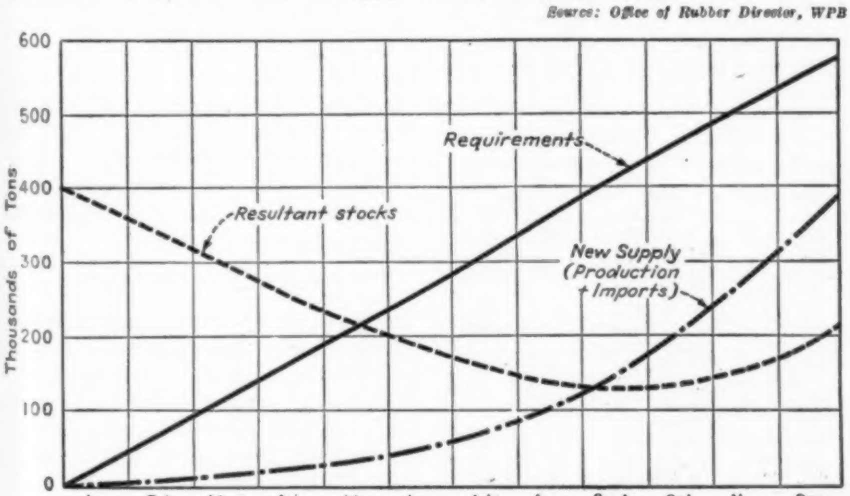
In any consideration of the postwar rubber industry guayule, natural rubber from Brazil and other friendly countries, and the reclaim rubber facilities of this country must be included.

We are still getting some rubber from Ceylon. Approximately 100,000 tons of rubber are produced annually in that country. This is being divided between Britain, Russia and the U. S. The Rubber Reserve Co. has agreed with the Firestone Plantations Co. of Liberia to purchase the latter's entire 1942 and 1943 production of crude rubber and latex. It is estimated that this will amount to 11,000 tons in 1942 and 13,000 tons in 1943. In 1941, this country imported 10,797 tons of rubber from Latin America. The Rubber Reserve Co. has contracted with the Brazilian Government for all of the exportable supplies of rubber for five years. This contract was followed by contracts with 16 other Latin American countries for all of their exportable rubber.

1943 U. S. Supply of Rubber vs. Essential Requirements

Reclaimed rubber and Buna N not included. Data on comulative basis. Resultant stocks difference between requirements and supply from initial stocks of 400,000 tons.

Source: Office of Rubber Director, WPB



Contracts have been made for the purchase of 18,700 tons of natural rubber from the Belgium Congo for delivery from 1944 to 1948 to come from trees yet to be planted.

Rubber Reserve Co. has sent representatives and technicians into most of these countries to assist in increasing the production and availability of wild rubber, it is expending large sums of money to improve transportation and working conditions, increase labor supply, and do whatever else may be necessary to get more rubber.

It is true that countless thousands of tons of rubber lie locked up in the jungles of the countries to the South but to make them available is a tremendous task.

The Baruch Report recommended a large increase in the program for guayule and the Department of Agriculture is taking steps to effectuate their recommendation, according to William M. Jeffers' Progress Report No. 1. This is expected to provide 33,000 tons of rubber late in 1944 and early in 1945. It is planned to establish another 120,000 acres next winter to produce an additional 47,000 tons of rubber in the harvest of 1945-46.

Reclaimed natural or synthetic rubber has certain characteristics in which it excels, but its principal use is in supplementing either crude rubber or synthetic rubber in the manufacture of articles. The capacity of the reclaiming plants at present is approximately 300,000 tons. The Baruch Report recommended that reclaim capacity be increased by about 20 percent. Reclaiming is now serving to conserve the stockpile of crude rubber and in the postwar period will merely serve this same purpose in the case of synthetic rubber.

A summary of this sort calls for some sort of conclusion, but predictions are dangerous. Perhaps it is safe to state that when peace returns to the world, and if rubber plantations are restored, shipping provided and war restrictions removed, then natural rubber will again be used for a large number of applications in whole or in part, but synthetic rubbers will retain numerous uses for articles in which their properties are superior and for new applications in which rubber has never heretofore been used.

Synthetic Organic Chemicals

The synthetic chemical industry has been increasing its productive capacity and at the same time developing new uses and expanding present markets, both at an unprecedented rate. It will emerge from this war immensely bigger and more virile than ever before in its history.

THE SITUATION in respect to all synthetic organic chemicals became tight during 1942, for these chemicals have quietly become of vital importance in our technology, both in times of peace and of war. It has taken the war to make many people realize this dependence on an industry that hardly existed during World War I. Those chemicals most in demand now and for which production capacities are being greatly expanded will naturally be the "surpluses" of the immediate postwar period. It will probably be safe to assume, however, that these surplus chemicals will quickly develop new uses and markets. Few chemicals are as adaptable in this respect as the synthetic organics, and this same flexibility characterizes the entire industry.

PETROLEUM SYNTHETICS

High-octane gasolines, especially since the commercialization of the catalytic alkylation process in 1938, have become more and more a blend of synthetic organic chemicals, mainly isooctane, neohexane, and isopentane. The nation's output of 100-octane fuels sky-rocketed during 1942, with additional new capacity still under construction. One large company alone is now producing more than 60 times as much high-octane aviation gasoline as it was making two years ago and is turning out far more of this super-fuel than the total requirements from all sources as recently as 1941. Work is being done on the use of other synthetic organic chemicals as blending agents for producing fuels in excess of 100-octane ratings. Such fuels have already been produced, and within the next few years they will undoubtedly be on the market in quantity.

During 1942 the petroleum industry continued to increase its output of toluol, and one petroleum concern has been awarded a contract by the government for a toluol plant that will have a capacity equal to the total annual output of this chemical in the United States during World War I. This country is now producing enough toluol from petroleum to make explosives for two-thirds of the bombs being dropped on our enemies. This is in spite of the fact that toluol was first produced in this country from petroleum on a large scale just two years ago!

Synthetic organic chemicals that will be required in large quantities by the various synthetic rubbers include butadiene, styrene, acrylonitrile, isobutylene, benzene, ethyl alcohol, chloroprene, butyl alcohol, ethylene and acetylene, furfural, dibuyl phthalate, ethylene dichloride, as well as various organic accelerators and antioxidants.

SYNTHETIC RUBBER CHEMICALS

Ultimate requirements for butadiene alone, which constitutes some 75 percent of Buna S rubber, are estimated by the Rubber Reserve Co. to be around 697,000 tons, although annual requirements at the end of 1943 will be considerably less. Of the ultimate production of butadiene, some 313,000 tons are scheduled to be derived from butylene raw material, 60,000 tons from butane, 225,000 tons from ethyl alcohol and 100,000 tons from hydrocarbons by refinery conversions.

This program would also require some 191,000 tons of styrene, to be made mostly by dehydrogenation of ethylbenzene. The first of the large-scale butadiene plants has just begun operations, while the styrene plants have been scheduled to start production between the fall of 1942 and the summer of 1943. Some 50 percent of styrene output has been going into synthetic rubber, the remainder being used in polystyrene plastics for war uses. Styrene capacity was officially allocated by the Rubber Reserve Co. during 1942 to the following chemical concerns:

	Tons per Year
Carbide & Carbon Chemical Corp..	25,000
Dow Chemical Co.	79,200
Koppers United Co.	37,500
Monsanto Chemical Co.	50,000

The need of butadiene for 132,000 tons per year of butyl rubber will amount to only about 6,000 tons, since the principal raw materials will be oil refinery isobutylene. The program for 68,700 tons of neoprene per year will require considerable chloroprene from acetylene and hydrogen chloride, and the 60,490 tons of Thiokol planned will increase production of ethylene dichloride.

Furfural, used in refining crude petroleum, will be in big demand as a solvent in making butadiene and the need for this chemical will increase substantially during 1943, requirements for which will be five or six times as great as those for 1942. After the initial demands of butadiene plants have been met, make-up requirements will be relatively small. Facilities to produce a substantial tonnage of furfural are being erected in the South, and it is expected that production will begin before the summer of this year.

The demand for dibutyl phthalate, which among other uses serves as a plasticizer in the Buna rubbers, has resulted in production of many times the 4,400 tons produced during 1940. Several thousand tons of carbon tetrachloride, hexachloroethane or other compound will be needed to act as orientation agent for polymerization of Buna S constituents.

ORGANICS FOR PLASTICS

Phenol, heavy-tonnage raw material for so many of our plastics, continued to grow in importance. Extensive expansions in production capacity were made in 1942, yet a shortage was felt throughout the year. The largest single unit was the new General Electric Co. plant in Massachusetts that

Table I—U. S. Production of Specified Non-Coal-Tar Synthetic Organic Chemicals [1]

	1939	1940	1941
Acetaldehyde	....	201,484,831	179,516,009
Acetic Acid (100%)	119,652,650	186,364,384	225,671,063
Acetone	....	201,506,334	....
Amines, total	1,487,643	1,960,441	3,190,659
Butyl acetate, total	77,734,214	86,721,057	100,381,337
Butyl alcohol, total	127,010,364	164,568,813	....
Butyl alcohol, normal	72,736,886	100,412,850	155,000,000[2]
Carbon tetrachloride	90,535,580	100,811,330	....
Ethyl acetate (85%)	67,897,408	75,368,803	94,689,878
Ethyl ether	....	....	22,645,521
Formaldehyde (40%)	134,478,827	180,884,573	277,000,000[2]
Isopropyl alcohol	179,062,266	219,925,900	....
Methyl chloride (100%)	3,021,078	3,041,661	4,911,360
Oxalic acid	10,416,269	12,921,227	15,851,200
Plasticizers, total	6,031,548	8,474,052	12,118,032

[1]Fr om U. S. Tariff Commission. All figures are in pounds.
[2]Approximated.

is expected to supply some 75 percent of this company's present requirements. Production of natural and synthetic phenol for the past few years has been approximately as follows:

	Million Lb.
1939	69
1940	96
1941	115
1942	145+

Actual output of synthetic phenol for 1943 may well exceed the 200 million mark. It is expected that the 1943 demand rate for phenolic resins will be 120 percent of the present over-all requirements. These, in turn, were satisfied to the extent of only 70 percent for December 1942. During the past year, some 50–60 percent of the total phenol production was diverted to resin manufacture. The same ratio will probably hold for the coming year. Appreciable amounts of phenol went into picric acid and picrates, and exports to Russia and other countries were large. Demands for diphenylamine continued.

Production of phthalic anhydride probably topped 100,000,000 lb. in 1942 and during the year the Barrett Division of Allied Chem. & Dye Corp. increased its capacity. The government continued to buy hexamethylenetetramine in large quantities.

Formaldehyde is being produced on a large scale by direct oxidation of natural gas. For 1941 some 48 percent of methanol production was converted into formaldehyde as compared to 29 percent so converted during 1940.

Vinyl acetate and chloride continued in big demand for the vinyl resins. Approximately 43 percent of the present vinyl acetate production is being diverted to acetal resins. Requirements for this monomer during the latter part of the year were about 130 percent of production capacity. This will probably rise to 200 percent by March 1943. Production facilities are being increased and by the middle of the year will amount to about 180 percent of present production capacity.

The magnitude of the demand for vinyl chloride is shown by the fact that the high-polymer resin (92 percent vinyl chloride) was being made at the rate of over 3,000,000 lb. per month during December 1942, according to one Government official, as compared to about 1,000,000 lb. per month during January of the same year. Present production will probably be expanded by an additional 60 percent by the middle of 1943. Production of the low-polymer resin (less than 92 percent vinyl chloride) has been made at the rate of about 25 percent that of the high-polymer product.

Table II—U. S. Production of Coal-Tar Synthetic Organic Chemicals [1]

	1937	1938	1939	1940	1941
Intermediates	575,893	401,943	607,175	805,807	1,006,564
Dyes	122,245	81,759	120,191	127,834	168,595
Color lakes and toners	18,041	14,407	18,154	19,213	26,278
Medicinals	14,800	11,097	15,188	18,214	29,775
Flavors and perfumes	4,356	3,837	5,349	5,485	9,931
Rubber chemicals	29,202	18,771	29,966	37,139	40,575
Miscellaneous	42,395	39,593	69,681	92,023	155,069

[1]As thousands of pounds. Data for 1937-41 from U. S. Tariff Comm.

DYESTUFFS AND SOLVENTS

Despite heavy demands from the armed services, it is estimated that the volume of dyestuffs sales will decline some 30–35 percent below the level of last year. This has been caused by the curtailment of civilian lines and drastic cuts in exports, which normally account for 15–20 percent of the domestic dye output. Possibly some 60–70 percent of all dye production goes to the armed services. These are mostly olive drabs and blues, capacity for which has been built up substantially.

While there are some 40 companies in dye manufacture, about 45 percent of the total production is accounted for by E. I. duPont de Nemours & Co., National Aniline & Chemical Division of Allied Chemical & Dye Corp., Calco Chemical Division of American Cyanamid and General Aniline & Film Corp.

Constructon of a new chlorinated hydrocarbon solvents plant by duPont in Michigan was completed, and operations began about the middle of the year. Meanwhile, demand for these chemicals continued to grow tremendously and productions of the more important items during 1942 are estimated roughly at 225,000 tons. Trichloroethylene leads, and the others follow in approximately this order: carbon tetrachloride, tetrachloroacetylene, perchloroethylene, ethylene dichloride, and chloroform.

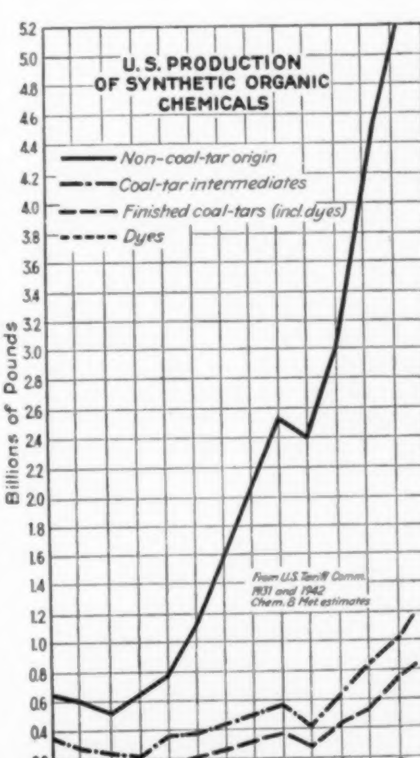
Supply of these chemicals was mainly for the purpose of cleaning and degreasing metals and metal parts, but at the expense of dry cleaning establishments. Propylene dichloride production was relatively small. After the war, enormous tonnages of these relatively new compounds will be available for dry cleaning as well as for metal degreasing.

Ethylene glycol, capacity of which was doubled during 1941 by the entrance of three new producers into the field, continued to be in heavy demand for liquid-cooled airplane engines. Government purchases of this chemical are expected to be substantial during the first part of 1943.

Production of all synthetic vitamins has soared during the past year. There was a tremendous demand for ascorbic acid (vitamin C), used in the fortification of dehydrated foods, which was reflected back to sorbitol, used chiefly as the raw material for this vitamin. The big new vitamin B plant of Merck & Co. in Virginia went into full production during 1942. Nicotinic acid, of which some 200,000 lb. was required during 1941 for flour fortification, remained tight.

Purchases of triethanolamine are also expected to be exceptionally heavy. Production of methyl ethyl ketone was reported to be already at the rate of approximately 8,500,000 gal. per year at the beginning of 1942.

Nitroparaffins produced by Commercial Solvents increased their range of usefulness as solvents and as raw materials for other organic syntheses. This group of organic chemicals has promising postwar prospects. Levulinic acid, manufactured by A. E. Staley Mfg. Co., attracted attention as a promising new commercial compound.



Alcohol and Solvents

Production and consumption of alcohol reached an all-time high last year but shortage of blackstrap molasses made it necessary to use more grain as raw material. Facilities of whiskey distilleries were used to round out supplies.

Domestic and lend-lease requirements for alcohol last year were speeded up more than had been anticipated and the sharply rising demands which are to follow when the synthetic rubber program gets into operation gave emphasis to the fact that the main problem of the alcohol industry was concerned with production. Alcohol and most other solvents were under allocation and price control so the usual problems of sales and competitive prices were largely eliminated. The question of turning out alcohol in the desired volume, however, was present in a dual form. In the first place it was necessary to shape the years output on a level which would satisfy consuming needs and then to arrange for enlarged productive capacity to take care of the increased demand which is expected to follow.

Early in the year it had been estimated that requirements for alcohol would approximate 275,000,000 gallons and it is probable that production was somewhat above that figure as it was brought out in hearings in connection with the synthetic rubber program that the rate of output at the end of the year was 400,000,000 gallons and it was further asserted that 54,000,000 gallons had been added to stocks most of which would be available for butadiene manufacture. Estimates for requirements in 1943 place the total in excess of 500,000,000 gallons so it will be necessary to expand production facilities considerably if that figure is to be met.

At the beginning of 1942, a number of alcohol producers had fairly large inventories of blackstrap molasses and it was the War Production Board's original plan to bring in 1,200,000 tons of blackstrap. Later, it was found expedient to increase sugar production and the blackstrap quota was cut to 700,000 tons. While a good deal of this molasses was brought in to New Orleans, virtually none was shipped north of Hatteras due to government restrictions. As a result, all eastern alcohol plants were closed when their stocks of molasses were used up. Efforts were made to convert these plants for the use of grain as a raw material but difficulties in getting the necessary grinding equipment greatly delayed this program and only two eastern plants produced alcohol from grain during the year and they were operated at a greatly reduced capacity. It is expected that all eastern plants will operate on grain some time in 1943 as soon as the necessary conversion makes it possible.

The use of alcohol in the anti-freeze trade was under allocation. Production of anti-freeze compounds was established at 42,000,000 gallons of which 24,000,000 gallons were to come from alcohol and 18,000,000 gallons from methanol and methyl-isopropyl mixtures. However, two different price levels were established by OPA and this worked against ethyl alcohol so that the amount actually sold for anti-freeze was smaller than had been allocated.

Prices for ethyl alcohol remained at 50c. a gallon throughout the year and the synthetic product sold at 26½c. a gallon but was available only in a small way.

METHANOL

Because of sharp rises in consuming demand, methanol has been in a strong position for the last three or four years. This situation was continued over all of 1942. All producers operated at capacity and during the year a government-owned plant came into operation which increased total capacity by about 10 percent. At the beginning of the year, The War Production Board made a survey of the various consuming fields and in order to conserve supplies suggested that a stock pile of methanol be created in anticipation of an unseen emergency. To build up this stock pile, the Board restricted the use of formaldehyde and cut down the amount of methanol allotted for anti-freeze. However, military needs for methanol did not materialize as rapidly as had been forecast and production exceeded consumption to an extent where storage problems became pressing. The restrictions placed on its use in anti-freeze were not lessened but larger amounts were permitted for manufacture of formaldehyde.

Hence, with the exception of anti-freeze, methanol was not too difficult to obtain over the greater part of the year. Possibly this accounts for the fact that no new capacity was authorized. But toward the end of the year it became apparent that some of the latent military uses would increase in 1943 and full allocation of methanol was ordered.

Two sets of price ceilings were set up, one for the wood distillation product and one for synthetic. As consumption of the heavy duty formulas containing denaturing grade methanol were reduced, wood distillation producers diverted the greater part of their production into anti-freeze and were able to dispose of their outputs at a price which was almost 100 percent higher than the material sold for five years ago.

With military uses expected to show decided increases in 1943, it is not clear to what extent the usual industrial users of methanol will be able to obtain supplies. The amount made available for anti-freeze purposes may be dependent on how much the non-essential use of formaldehyde can be curtailed.

ACETONE

Demand for acetone which became very active in 1941 was further increased in 1942 as a result of lend-lease and military requirements. To meet this enlarged demand producers stepped up production and it is estimated that the output was more than 400 percent higher than the amount turned out in the 1937-1939 period. The greater part of this increase was made by producers of synthetic but fermentation producers likewise turned out more because of the substitution of grain for molasses as a raw material. One of the fermenters, however, curtailed production late in the year because of plant difficulties.

While increased production and consumption were noteworthy, the most interesting market development was found in the price situation. OPA authorized a price of 15.8c. a lb. for fermentation material but restricted quotations on the synthetic product with the result that, except for a short period when demand was greater than production, fermentation producers were unable to sell on a competitive basis. This led to a reduction in price on the part of one producer but the other did not follow suit. The unsettled price position finally led to an official order reducing prices for both butyl alcohol and acetone. This did not meet with the approval of fermentation interests and there was the possibility that the lower price levels would result in a lowering in outputs.

HIGHER ALCOHOLS AND ACETATES

Although normal buying of solvents was curtailed because of lower outputs of automobiles and furniture, new military demands for protective coatings increased so rapidly that normal butyl alcohol production was the highest in the history of the industry. Even then the supply was not ample as stocks were very limited particularly at the

end of the year and with consuming requirements still increasing it is probable that very little will be available in the first part of 1943 except for essential and military uses. Special military requirements, dopes for the aviation industry, and lend-lease are given as reasons for the large increase in demand for butyl alcohol.

On the other hand, production of acetates fell off somewhat since there were less lacquers produced for civilian purposes because the raw materials were lacking. Another factor was that acetic acid was under pressure over most of the year because of the military requirements for the acid itself as well as the raw material going into it. There was also a drop in production of synthetic amyl acetate because the alcohol was requisitioned by military agencies and the shortage of chlorine also had some influence.

In the early part of the year some fusel oil was available from whiskey plants but it was not under ceiling prices and bidding for these stocks became so spirited that it was not long before the selling price was higher than that for normal butyl alcohol. Demand for secondary butyl acetate was active throughout the year but outputs were limited as the greater part of the alcohol was being diverted into methyl ethyl ketone.

METHYL ETHYL KETONE

Methyl ethyl ketone was another product for which demand was larger than the supply although the latter was pushed up to record levels. Certain types of military materials require this solvent and there was a steady diversion from the regular distribution channels to purely military needs so that in the latter part of the year only about 14 percent of production was going into civilian use. While capacity production may be expected to be maintained there are no indications of any increases in plant facilities and the market may be under pressure in the coming year.

PICTURE OF THE INDUSTRY

With projected production of ethyl alcohol five times the largest amount produced in normal years and production of isopropyl alcohol greater than the normal production of ethyl—exclusive of anti-freeze—and with methanol supplies 50 percent larger than normal, there is considerable speculation relative to the long range post-war position of the solvent industry and the several individual products. It should first be considered that 50 percent of the present alcohol capacity is coming from whiskey plants. As stocks of whiskey are rapidly being depleted, these plants will naturally wish to return to their own line of business. Furthermore there is an enormous pent-up demand for consumer goods of a type which requires large amounts of alcohol and other solvents, these including automobiles, refrigerators, radios and furniture.

Assuming that national and international planning reaches a proper financial understanding there should develop large export trade of a lease-lend variety until Europe and Asia are rehabilitated or at least until they become partly self sustaining. Also it should be recognized that many developments which consume alcohol and solvents have received an impetus during the war period so that post-war production should be at a level which will be probably fifteen years in advance of the volume which would have come from normal growth.

The very large new outlet which is opening up for alcohol in the synthetic rubber industry may suffer considerable contraction when natural rubber is again readily available but synthetic rubber undoubtedly will force a market position for itself and must be reckoned with as a post-war factor. Greater uses for resins likewise seem assured for the future and generally speaking the cutting off of uneconomic production combined with increased consumption in industrial lines may stabilize the solvent industry somewhere between the peaks of war-time demands and the previous highs of normal years.

The outlook for ethyl alcohol may require some special attention. The normal development would seem to lie in producing large quantities at lower prices in order to reach new markets and to stimulate those uses which were created during the war. However, as a result of the synthetic rubber prospective demands, there has been a movement in certain quarters to have government-financed alcohol plants erected in agricultural areas. During the coming year, three of these will be put into operation. On the one hand, there is an attempt to maintain prices for grain at relatively high figures and at the same time to use this high-priced raw material for the manufacture of alcohol. It is apparent that alcohol so produced will not be able to compete with that made synthetically or from low-priced molasses and a decision will have to be made whether it is better for the country to scrap the high-cost plants and let the alcohol industry develop along truly economic lines.

Paint and Varnish

For the first half of last year, paint makers were forced to operate plants at a very high rate in order to take care of the combined military and civilian requirements. Later on some of the large government projects were completed and at the same time civilian demands were lower than had been anticipated. Then volume of sales began to fall with the result that the relatively poor showing of the last six months brought the year's total under that of the preceding year. The decline from 1941 was not large, amounting to less than 5 percent on a dollar basis. Lacquers contributed more than a proportionate share to this unfavorable showing as sales dropped about 24 percent in volume and about 16 percent in value.

Sales of Paint, Varnish, and Lacquer

		Classified sales reported by 580 establishments				Unclassified
			Industrial sales			
1942.	Total sales reported by 680 establishments.	Trade sales of paint, varnish and lacquer.	Total.	Paint and varnish.	Lacquer.	Unclassified sales reported by 100 establishments.
Jan	$47,044,491	$22,842,005	$19,190,138	$13,825,151	$5,364,987	$5,012,348
Feb	45,175,827	22,126,413	17,618,656	12,742,490	4,876,166	5,430,758
Mar	48,070,117	23,718,650	18,897,968	13,929,484	4,968,484	5,453,499
April	50,530,225	25,839,940	19,009,421	14,348,955	4,660,466	5,680,864
May	49,204,268	26,000,489	18,140,194	13,692,283	4,447,911	5,063,585
June	43,981,828	22,430,391	17,082,263	12,669,482	4,412,781	4,469,174
July	47,220,566	20,813,396	17,173,192	12,734,267	4,438,925	4,233,978
Aug	41,105,740	20,187,334	16,748,036	12,077,079	4,670,957	4,170,370
Sept	43,027,934	20,539,579	17,242,815	12,582,672	4,660,143	5,245,540
Oct	44,121,665	21,279,899	17,906,344	13,202,985	4,703,359	4,935,422
Nov	38,121,550	18,094,223	16,220,583	11,758,522	4,462,061	3,806,734
Dec	37,140,816	16,612,321	16,905,380	12,295,253	4,610,127	3,623,115
Total, 1942	$529,745,027	$260,484,650	$212,134,990	$155,858,623	$56,276,367	$57,125,387
1941 total	555,398,819	276,168,508	277,400,363	162,632,021	64,768,342	51,829,948
1940 total	412,515,812	214,155,268	159,965,142	111,718,366	18,216,776	38,395,402

Rayon and Synthetic Fibers

No fly-by-night wartime industry, rayon has established another record which may well be preliminary to still higher peaks after the war. The total for all cellulose-based synthetic fibers amounted to 632,615,000 lb., an increase of 10 percent over 1941. Staple's increase was a full 25 percent.

As was the case everywhere else in the world where there is a rayon industry, the war has given a tremendous boost to the production of rayon and other synthetic fibers in the United States. In fact, the output of both filament yarns and staple fiber was at a higher level than the capacity which had been predicted the previous year for 1942. Data on the exact output of the non-cellulose-based fibers are not available, but they also are expected to have increased considerably. For the cellulose-based materials, an overall increase of about 10 percent for both filament yarn and staple was composed of a 6 percent increase for filament yarns, and a 25 percent rise for staple. Viscose (plus cupra) filament yarns increased by 8 percent, and acetate yarns, by 3 percent.

The average denier of viscose and cupra yarns spun increased slightly as compared with the preceding year, but not enough to account for more than a minute part of the increased poundage. On the other hand, raw materials for acetate were scarce and the industry intentionally decreased the average denier in order to stretch the available materials as far as possible. There is a tendency toward the spinning of finer deniers, since finer filaments improve the resulting textiles for many purposes, but it is probable that somewhat more acetate poundage, of slightly higher denier, would have been produced if the raw material situation had been more satisfactory.

Definite figures on the proportion of rayon output which has "gone to war" were not made public, but the amount is large and is growing larger. For example, approximate doubling of the high-tenacity yarn capacity is being carried out, to permit an output of 100,000,000 lb. per year of this material, distributed among the five largest viscose yarn producers, and all of this production is earmarked for the government. High-tenacity yarns go principally into tire cords, where their use permits a lighter tire of better mileage, capable of being retreaded more often, all with a sizable saving in rubber. Such yarns also go into self-sealing gasoline tanks and into parachute shroud lines. Rayon enters into many other military items, including parachutes for fragmentation bombs and for dropping supplies, linings for clothing and sleeping bags, tow targets, bands, handkerchiefs and neckerchiefs.

On the civilian side, rayon has been called upon to substitute for the entire normal requirements of silk and nylon. Both the remaining silk stocks, and the entire output of nylon (now probably approaching the projected capacity of 20,000,000 lb. per year), have been taken over for military requirements. One of the biggest civilian jobs that rayon has had to take over has been in hosiery, a job for which the presently available yarns are not entirely suited. Aside from this, however, rayon has entered new fields from which it is not liable to be ejected after the war. Even hosiery may in considerable part remain a rayon market, once the high tenacity products return to civilian use, despite

Rayon Production and Imports 1921-1942

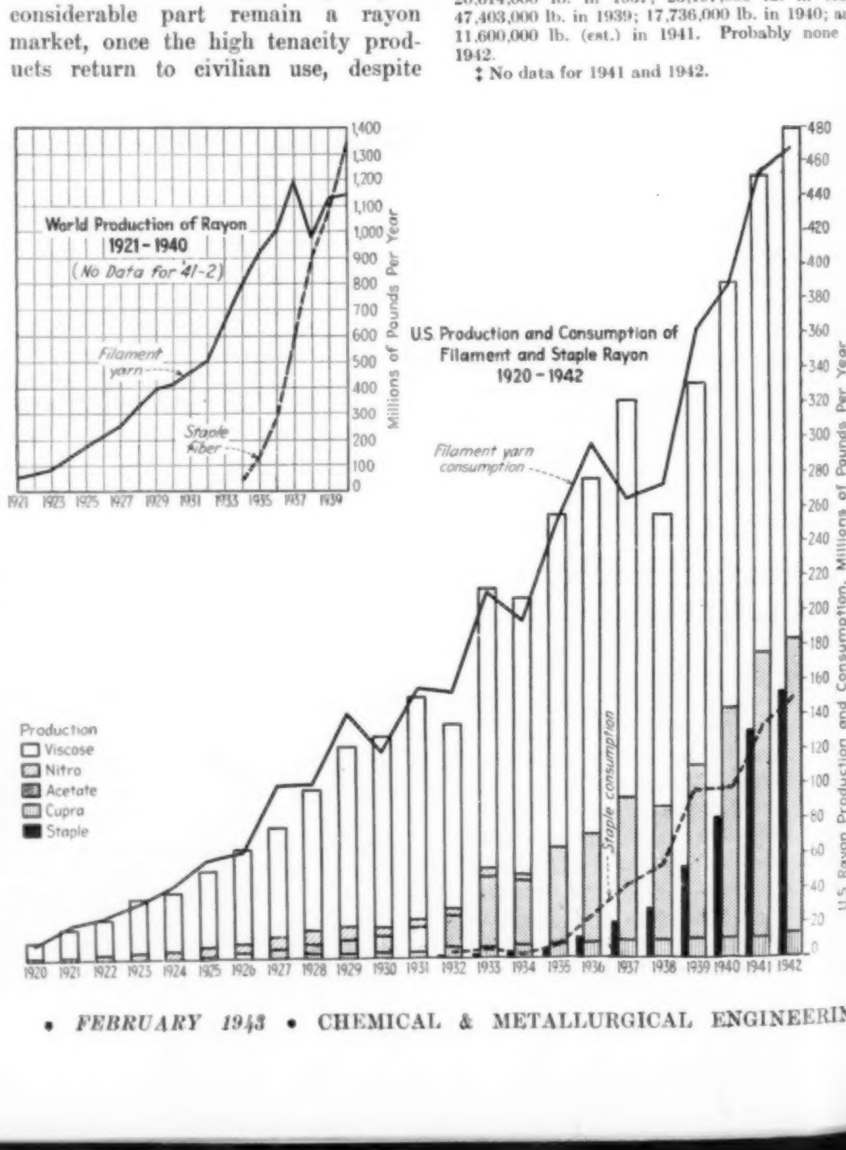
	Thousands of Pounds		
	U. S.* Production	U. S.† Import Balance	World* Production
1921.....	18,000	3,276	65,000
1922.....	26,000	2,116	80,000
1923.....	35,000	3,029	97,000
1924.....	38,750	1,954	141,000
1925.....	52,200	5,293	185,000
1926.....	62,575	8,945	219,000
1927.....	75,050	14,633	267,000
1928.....	97,700	11,948	345,000
1929.....	121,399†	14,832	404,000
1930.....	127,333†	5,995	417,000
1931.....	150,879†	1,490	470,000
1932.....	131,670†	−456	509,000
1933.....	213,498†	−176	660,000
1934.....	208,321†	−2,432	799,589
1935.....	257,557†	−2,193	932,780
1936.....	277,626†	−1,558	1,022,000†
1937.....	321,681†	−525	1,199,000†
1938.....	257,916†	−1,195	990,000†
1939.....	331,200†	−1,703	1,145,000†
1940.....	390,072†	−1,440	1,143,960†
1941.....	451,204†	‡	‡
1942.....	479,330†	‡	‡

* From *Textile World* except as noted; does not include staple.

† From *Rayon Organon*. Does not include staple which is estimated at 350,000 lb. in 1930; 880,000 lb. in 1931; 1,100,000 lb. in 1932; 2,100,000 lb. in 1933; 2,200,000 lb. in 1934; 4,600,000 lb. in 1935; 12,300,000 lb. in 1936; 20,244,000 in 1937; 29,861,000 lb. in 1938; 51,300,000 lb. in 1939; 81,098,000 lb. in 1940; 122,026,000 lb. in 1941; and 153,285,000 lb. in 1942.

World staple estimated at 6,100,000 lb. in 1930; 52,700,000 in 1934; 139,900,000 lb. in 1935; 299,000,000 lb. in 1936; 619,000,000 lb. 1937; 958,000,000 lb. in 1938; 1,025,000,000 lb. in 1939; 1,236,850,000 lb. in 1940‡. Import balance does not include staple; minus sign indicates net exports; staple imports 12,721,000 lb. in 1936; 20,614,000 lb. in 1937; 23,197,000 lb. in 1938; 47,403,000 lb. in 1939; 17,736,000 lb. in 1940; and 11,600,000 lb. (est.) in 1941. Probably none in 1942.

‡ No data for 1941 and 1942.



the possible return of silk, and the certain return of nylon and other synthetics. This follows from the belief of rayon men that physical properties of the fiber, rather than chemical composition, will be the characteristics determining fields of use. And rayon men are learning how to develop the desired physical properties in their products to the extent that even wool may shortly not be secure in its field of heat-insulating the human body.

So far, the expected wool stringency has failed to develop to the extent anticipated, and rayon consequently has had to do only a little substitution for this natural fiber. Textile experts, however, feel now that it is the elasticity and crimp of wool, rather than its scaliness, which impart the air-trapping qualities of its fabrics. Beginning to learn how to produce similar qualities in rayon, they anticipate that wool will soon be the next natural fiber to have to fight for its markets against rayon. The day may not be distant when wool-like fabrics which contain no wool at all will be found entirely suitable for the purposes for which wool is now supreme.

As in the past, it is through the courtesy of *Rayon Organon* that we are able to report the 1942 statistics of the rayon industry which are assembled and reported by that agency. Despite the virtual cutting off of staple fiber imports, substantially increased staple production allowed the industry to turn out in 1942 a total of 632,615,000 lb., compared with 573,230,000 lb. in 1941. This was composed of 479,330,000 lb. of filament yarns plus 153,285,000 lb. of staple fiber, compared with 451,204,000 lb. of filament yarns and 122,026,000 lb. of staple fiber in 1941. About 35 percent of the filament yarn, or 168,855,000 lb., was acetate; and nearly 65 percent, or 310,475,000 lb., was viscose plus cupra (of which we estimate 14,000,000 lb. was cupra). In 1941 about 15 percent of the staple was acetate, but it is probable that the percentage was considerably lower in 1942.

Consumption, also, increased materially over the preceding year although to a somewhat smaller extent than production. Consumption of both filament and staple was estimated by the *Organon* at 620,624,000 lb., compared with 591,710,000 lb. in 1941. In the earlier year, however, staple was still being imported and something in excess of the 11,595,000 lb. of imports reported in the first nine months of 1941 (at which time import data were discontinued) was added to domestic production and available for consumption.

A number of new products of interesting potentialities were introduced during the year, including a bubble-filled cellulose "straw" for heat-insulating and buoyancy-requiring applications, as well as paint brush bristles, made both of nylon and rayon. Rayon tow for mechanical packings was another new material which has already attracted much attention among packings manufacturers.

An interesting characteristic of the notable increases made by rayon in the United States is that these fibers have largely attained their position on their own merits, and not because of a difficiency of other fibers, as in some foreign countries. On this firm foundation the industry is sound in anticipating continual growth after the war. Its capacity peak has by no means been reached, a statement which is hardly likely to be true for all products of the chemical industry.

SULPHURIC ACID

(*Continued from page* 104)

acid refining operations. Acid lube oil refining has been revived to some extent, due both to the shortage of solvents and to the difficulties of equipment supply. On the other hand, in some refineries there is no opportunity to employ the acid which has been used in alkylation, and some of this partially spent acid has already come on the market. In other areas, where a market for the spent does not exist, refineries have begun to accumulate this so-called "sludge acid" although it is still relatively free of hydrocarbons, and perhaps as strong as 90 percent H_2SO_4. To assist such refineries a regeneration process has recently been introduced which reduces the sludge acid to SO_2 and reconverts this to new strong acid, together with any necessary make-up from sulphur, all with an overall loss of acid in both alkylation and regeneration of not over 10-15 percent.

Among other uses of acid, fairly large increases took place in rayon and cellulose film, paints and pigments, iron and steel and other metallurgical uses, and in miscellaneous applications. Smaller increases occurred in coal products (ammonium sulphate) and in industrial explosives. Only in the textile industry, among major users, was a smaller acid requirement met in 1942 than in 1941, but even this was well above 1939 and 1940.

Unfortunately, wartime elimination of some of our usual sources of information, notably imports and exports, makes it difficult to be entirely certain of our estimate of the acid which was produced in 1942. One of the tabulations on page 104 presents data and estimates on sulphur and other acid raw materials, and on the quantity of acid we believe to have been made, for the years 1940 to 1942. With the exception of 1940, where Bureau of Mines data have been used for sulphur mining, exports, shipments and stocks at mines, as well as for pyrites use and acid production at smelters, the data are largely either trade or *Chem. & Met.* estimates.

From 11 months' actual figures of the Bureau of Mines, it is evident that sulphur mining in 1942 was much ahead of even the previous record year of 1941. The sulphur mined evidently approximated 3,460,000 long tons, compared with an estimated 3,150,000 tons in 1941. However, both government and producers had urged sulphur users to stock up in 1941, so that much of the shipment in that year was for stocking, while in 1942 users' stocks increased only slightly. Hence, shipments of sulphur from the mines were less in 1942 than in the earlier year. Our tabulation combines sulphur exports in 1942 with the estimate for non-acid uses of sulphur, so as to conceal the former figure. The estimate for sulphur production also includes imports of sulphur from the smelter-gas recovery plant at Trail, B. C., as well as the sulphur mined in California and that recovered in wet fuel-gas purification.

Although importation of Spanish pyrites was not entirely cut off in 1942, little of this material was available. However, Canadian mines stepped up their output so that almost as much acid was made from the estimated domestic pyrites, plus Canadian and Spanish imports, as in the previous record year.

To recapitulate, we estimate that the acid production in 1942, on the basis of a standard concentration of 50 deg. Bé., was 9,150,000 short tons from sulphur, 2,090,000 tons from domestic and imported pyrites, 1,200,000 tons from smelter gases, and 80,000 tons from hydrogen sulphide at the several plants where sour refinery gases are purified, with the manufacture of acid as a byproduct. This totals 12,520,000 short tons, which is more than 50 percent in excess of the production of so recent a year as 1939.

Fats and Oils

Raw material supplies for fats and oils must be increased by the time-consuming process of planting, cultivating and harvesting of more acres of seed crops. More livestock must be raised and slaughtered. Domestic sources must be exploited in full to offset the reduction in imports.

PRODUCTION of fats and oils from domestic raw materials in 1942 was estimated at 11,700,000,000 lb. against a total of 9,600,000,000 lb. in 1941. However, this increase was entirely accounted for by the steadily growing war requirements of the Allied nations and the curtailment of imported oils. Severe limitations of civilian uses thus became necessary to insure that dwindling stocks would be sufficient to provide for essential uses.

The Bureau of Agricultural Economics estimates that 1943 requirements of fats and oils for military, civilian and lend-lease uses will be approximately 15,300,000,000 lb. including a 1,500,000,000 lb. reserve for military needs. These requirements are about 800,000,000 lb. more than the visualized supply and, therefore, further control and reduction of nonessential civilian consumption is expected in 1943.

One outstanding feature of the 1942 fats and oils market was the effect of OPA ceiling prices in reducing the frequency of price fluctuations. Prices generally moved upward during the first quarter of the year, but remained thereafter fairly constant, with some prices decreasing slightly.

Soap and Glycerine—The production and sales of soap which had risen to an unprecedented level during the previous three years began to fall off in the middle of 1942 as the shortage of raw materials became more acute and government control tightened. Until then the soap industry had not been too seriously affected by the war program although some substitutions of raw materials had been necessary.

The loss of coconut oil supplies from the Far East provided the major problem for soapers in 1942 and still remains to be solved as shortages of other raw materials begin to be felt.

Tallow, which in 1941 constituted about one-half of the total fats and oils in soap, became increasingly difficult to obtain during the latter part of the year and is expected to become even more scarce in 1943. This shortage can be attributed to increased lend-lease shipments, large soap requirements for the synthetic rubber industry and the differential between the highest grade inedible tallow and edible tallow.

The government shows no signs of releasing for soap production any tallow which could be used for edible purposes, at least until it is certain that there will be sufficient edible fats to feed the U. S. and its allies. Vegetable oils likewise are being allocated largely to edible products, and further reduction in soap output is apparently inevitable as food assumes more and more importance in the war effort.

It appears to some authorities that the soap industry's production of glycerine may be reduced to a point where munitions makers will have difficulty in securing adequate quantities of this material to maintain and expand the present rate of production. Although there are known processes for making synthetic glycerine, the burden of supplying this important material has thus far fallen upon the soapers and fatsplitters. Ceiling prices for glycerine and shortages of critical equipment have combined to prevent the expansion of synthetic glycerine plants.

Essential uses for synthetic organic detergents including sulphonated fatty acids and the newer sulphonated hydrocarbons obtained from petroleum increased during the past year resulting in curtailment of civilian uses and some expansion of facilities for production. One important use was in hard-water and salt-water soaps for the Army and Navy. Large amounts were also consumed in the textile and metals industries.

Avitone, a petroleum product introduced by du Pont in 1942 has been used as a substitute for sulphonated tallow in producing textile finishes. According to the manufacturer 100 lb. of Avitone used for this purpose will release 140 lb. of tallow for other essential uses such as glycerine production.

The use of rosin as a partial substitute for coconut oil became more widespread in 1942. Sodium rosinate closely resembles sodium laurate chemically and has been found to increase the solubility and lathering properties of some soaps. The objectionable yellow color can be largely eliminated by hydrogenation so that a fairly white soap results. Practice has been to saponify most of the rosin and grain out the batch with salt before adding to the main soap pan.

Soapers experienced considerable difficulty in obtaining maintenance parts for equipment such as pumps, piping and tanks during 1942. This condition will not improve materially in the near future and existing equipment must be kept in service for some time to come.

Drying Oils—The chief developments in drying oils during 1942 are directly traceable to the loss of the Far Eastern supply of chinawood, or tung, oil. Practically the only natural oil available in quantity as a replacement for tung oil is oiticica oil which is obtained from Brazil. However the extent of this supply, or how much of the oil will be available for use during the present emergency, is not accurately known. It has been variously estimated that if the production of oiticica oil were speeded up it might reach as high as 80,000,000 to 100,000,000 lb. per year against an estimated war-time demand for tung oil of 150,000,000 lb. Some production of tung oil has been obtained from plantings in the United States, but

Factory Production and Consumption of Secondary Fats and Oils

	Millions of Pounds					
	Production			Consumption		
	1940	1941	1942	1940	1941	1942
Shortening	1,190	1,410	1,299	2	2	3
Hydrogenated oils	803	917	1,095	791	919	1,072
Vegetable foots (50%)	280	327	279	188	275	242
Glycerine, crude (80%)	197	245	222	207	260	236
Glycerine, dynamite	72	88	110	41	58	56
Glycerine, C. P.	90	114	77	34	42	32
Fatty acids	165	211	182	118	133	130
Stearin, vegetable	72	86	79	69	77	70
Stearin, animal (ined.)	21	40	45	15	18	13
Stearin, animal (edib.)	36	46	55	27	31	40
Lard oil	28	51	67	13	22	34
Red oil	53	77	76	33	50	49
Stearic acid	41	56	52	16	21	23
Tallow oil	9	11	10	5	7	9
Acidulated soap stock	49	63	92	60	70	67
Misc. soap stock	2	2	5	2	2	5

Products in this table result from refining or processing of all fats and oils, both imported and exported. They represent as complete a statistical picture of the fats and oils process industries as is possible from the figures reported by the Bureau of the Census.

It should be noted that these statistics relate to 'factory' production and consumption only. Households, hotels, bakeries, local painters, etc. are not included.

Factory Consumption of Raw Materials in the Manufacture of Vegetable Oils

	Thousands of Tons		
	1940	1941	1942
Cottonseed	3,933	4,365	4,422
Soybeans	1,718	1,971	2,490
Flaxseed	884	1,256	1,396
Corn Germs	242	304	371
Castor Beans	110	172	162
Peanuts	137[1]	*	*
Copra	275	255	64[2]
Tung Nuts	*	*	8[3]
Olives	14	35	19[4]
Babassu Nuts	48	36	*
Other Kinds	28	34	67

*Not Available.
[1]1938 figure latest available.
[2]Not including July—Sept. or Nov.
[3]Jan. thru June only.
[4]Jan. thru Mar. only.

the tremendous increase in the need for drying oil for surface coatings to be used on war products has been supplied by dehydrated castor oil, the chief manufactured substitute for tung oil. Some linseed and soybean oils have also been used for this purpose.

One of the important uses of dehydrated castor oil during the past year has been in the manufacture of camouflage paint for the Army and the Navy. This application has resulted in rapid development and expansion of the new water-in-oil emulsions. Castor oil is also being used extensively for aircraft as a lubricant which has fairly constant viscosity over a wide range of temperatures. Its use as an ingredient in hydraulic fluids for brakes, revolving tank turrets, and recoil mechanism is well known. The petroleum industry is using large quantities of castor oil for breaking emulsions, and the textile industry has long used sulphonated castor oil as a mordant in finishing cotton and wool fabrics of the type used in military uniforms.

The flax seed crop of 41,000,000 bushels surpassed all previous records and was adequate for linseed oil producers who depend on domestic markets. However, some crushing plants, particularly in the New York area, obtain their seed from South America and consequently ran short of seed in the end of the season because of a sharp reduction in imports.

Edible Fats—Edible products assumed major importance in 1942 as food became one of the most powerful weapons of the allied nations. 1942 shipments of fats and oils under lend-lease amounted to 723,000,000 lb. or 13.2 percent of the nation's supply. The government, in an effort to meet the increased need for food fats, fostered a civilian fat recovery program and encouraged farmers to increase their oil-yielding crops. Peanuts, soybean and corn oil were particularly desired by the government for edible use.

Lard which is the most important of our domestic supplies of fats and oils was purchased in huge quantities for lend-lease during 1942, causing supplies to diminish rapidly. Hog prices reached and maintained high levels despite increased production of hogs. The high prices being paid for hogs and the abundance of feed available indicates that this large production of hogs will continue in 1943. It is estimated that 95,000,000-head will be slaughtered in the season from October 1942 to September, 1943.

Statistics—Abnormal yields of domestic and Canadian flax seed tended to offset a reduction of about 50 percent in imports from Argentina during the past season. The 1942 domestic crop amounted to 41,000,000 bushels, a 35 percent increase over 1941, and would have been as high as 45,000,000 to 50,000,000 bushels except for the rust which developed during the summer in the principal states which produced flax seed.

A shortage of transportation during 1942 hindered marketing of soya beans, thus slowing up the oil mills. For this reason soybean oil was difficult to obtain late in the year, despite the fact that the 1942 production of beans amounted to 210,000,000 bushels as compared to 106,000,000 bushels in 1941.

Fish-oil prices were unusually high during 1942. The demand was caused by a scarcity of fish oil and the high cost of other oils. On both the east and west coasts submarines and mines made fishing operations hazardous. In addition much of the fishing fleet was requisitioned by the Navy for patroling and other war-time operations.

Sales of paint, varnish, lacquer and filler amounted to $529,750,000 in 1942 against $555,400,000 in 1941.

According to the report of the Association of American Soap and Glycerine Producers, Inc., 1942 sales of soap amounted to $364,000,000, an 11.7 percent increase over 1941 sales and 40.5 percent over 1940 sales. These figures are based on sales by 75 manufacturers who account for about 90 percent of the total soap produced and sold in the U.S. 2,931,000,000 lb. of soap are included in the 1942 sales which were 6.6 percent less than 1941 sales on the poundage basis.

Government Controls—M-71, the general conservation order, designed to conserve supplies and direct distribution of fats and oils was issued originally on December 29, 1941, and imposed rigid restrictions on the uses of these materials for certain end products. Latest revision of this order permits the use of fats and oils as shown in the following table:

End-use	Permitted percentage of base period
Margarin	180
Other edible products	88
Soap, not made from foots	84
Soap, made from foots	150
Paints, varnishes, etc.	70
Linoleum, oil cloth and coated fabrics	70
Printing inks	90

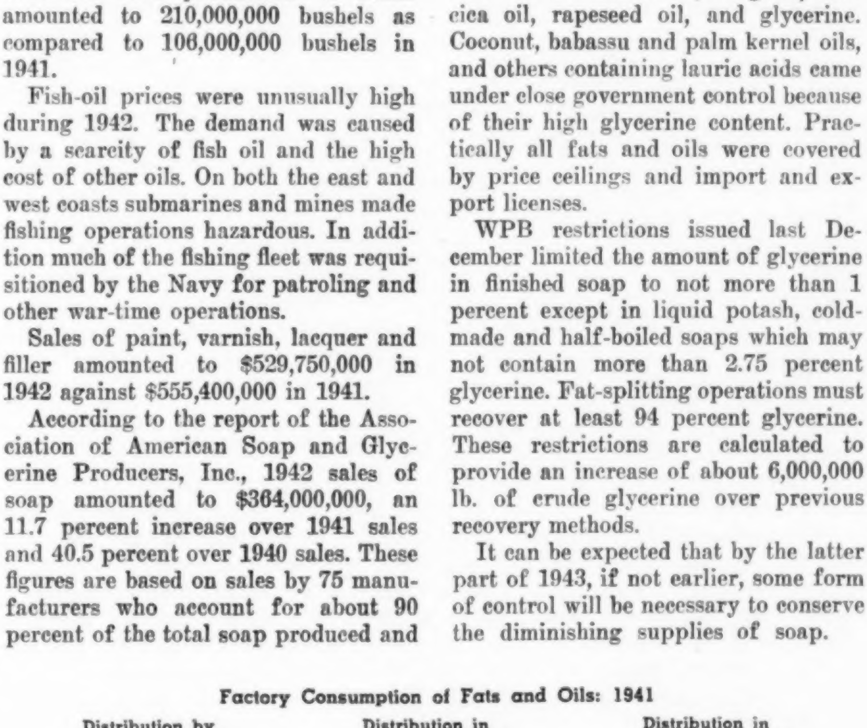
Reduction in the amount of oils permitted in the manufacture of soap is expected to save approximately 70,000,000 lb. of oil.

Individual conservation orders affecting the fats and oils industry were issued during 1942 covering the direct allocation of castor oil, tung oil, oiticica oil, rapeseed oil, and glycerine. Coconut, babassu and palm kernel oils, and others containing lauric acids came under close government control because of their high glycerine content. Practically all fats and oils were covered by price ceilings and import and export licenses.

WPB restrictions issued last December limited the amount of glycerine in finished soap to not more than 1 percent except in liquid potash, cold-made and half-boiled soaps which may not contain more than 2.75 percent glycerine. Fat-splitting operations must recover at least 94 percent glycerine. These restrictions are calculated to provide an increase of about 6,000,000 lb. of crude glycerine over previous recovery methods.

It can be expected that by the latter part of 1943, if not earlier, some form of control will be necessary to conserve the diminishing supplies of soap.

Factory Consumption of Fats and Oils: 1941



Inter-Fuel Competition—A Postwar Certainty

The inter-fuel and inter-energy competition which lies ahead in the postwar period has many chemical engineering implications. This competition will affect both available byproduct supplies and fuel prices which the process industries must pay.

Gas supply for households and for industry during 1942 made a record with respect to natural, manufactured, and coke oven gas. Still higher records will be made in 1943.

Chemical process industries are much concerned with present conditions and prospective trends because they pay fuel or energy costs for much manufacturing and the fuel activity also determines the quantities of many byproduct chemicals which are available. The inter-fuel and inter-energy competition which lies ahead in the postwar period, therefore, has many important chemical engineering implications. Some of these are best understood from the figures of actual operations in 1942.

ANTHRACITE COAL

Anthracite coal production increased in 1942 to 68 million tons from 53 million tons in the preceding year. If labor will cooperate, the 1943 production will be still higher. The demand which is making these records originates in the shortage of coke for household use and the inability to get desired quantities of gas and oil for both industrial and household heating. In other words, the 30 percent increase last year was a substitution forced on somewhat unwilling customers. A great fall in anthracite demand may be expected, therefore, when postwar supplies of fluid fuels are again ample.

Bituminous coal output of about 575 million tons last year was 12 percent above the preceding year. A large decline in bituminous coal requirements may be expected in the immediate postwar period for two reasons. First, there will be the inevitable closing down of many war factory operations. In the second place, there will be much further conversion of solid fuel equipment in homes and industry to a petroleum or gas fuel.

The interruption in use of fluid fuels has been most unwelcome to the householder as well as to the factory management. When there is an abundant supply, as there will be when pipe lines are completed and tankers again move along peace-time courses, much less solid-fuel use should be expected. And it is certain that some arrangements will be demanded by the public to ensure that there are permanently available adequate transportation facilities to prevent interruptions in supply in future emergencies. The price of fluid fuels at points of use can be expected to be enough lower, because of improved transportation efficiency, so that this factor, as well as the convenience, will speed up the trend away from solid fuels.

Electric energy supply for home and industry has been continuing at unprecendented levels. Almost without interruption, every month of recent years has furnished us a new all-time record in electrical energy production and use. On the average, the 1942 figures are about 12 percent above those of the preceding year. Increased power plant capacity, made despite priority difficulties, ensures that 1943 will continue to make new records. There will doubtless be some break in this uptrend during the readjustment at the end of the war. But there is every reason to believe that process industry and householders will both continue to demand more electric power as well as more fluid fuels.

GAS SUPPLY

Gas supply by public utility companies also made new records last year. At the end of the year gas utility companies were supplying approximately 19.2 million customers, of whom 10.7 million received manufactured gas and 8.5 million natural gas. Not a single division of either natural or manufactured gas had a decline in sales as compared with the preceding year. This is rather an amazing record in view of the restriction placed on use of gas where solid fuels could be had. Even with the drastic orders of WPB issued on Jan. 1, 1943, it is expected that gas space heating will continue to make new records during the coming year. The gain in industrial sales by utilities last year were 9.1 percent for manufactured gas and 17.5 percent for natural gas. The total of all utility gas sales increased 10 percent and 8.6 percent respectively.

Last year approximately 3 trillion cubic feet of natural gas was marketed; and well over that huge total is going to be sold during 1943. Three trillion cubic feet is approximately equivalent in heating energy to 124 million tons of coal, or 880 billion kilowatt hours of electricity, or 540 million barrels of fuel oil.

The main limitation on natural gas supply for a few years to come will be difficulties of pipeline transportation. Some important demands for gas remain a problem, especially in the Appalachian region; but Midwestern and Southern areas anticipate little likelihood of a natural-gas shortage except for brief periods of unusually cold weather. It is anticipated that further major pipeline developments will be required within the next 18 months. Since wartime necessity, as well as postwar business, favors these projects they are likely to be undertaken and completed, despite questions as to the supply of steel involved.

Coal Products

Present conditions governing coke, byproducts, gas and processed fuel supply will be radically changed and many trends will be reversed at the end of the war. Forecasting in detail is futile, but some of the outstanding factors which will interest chemical engineers both as producers and major users of these fuel products are beginning to show through the confusion caused by rationing and shortages.

During 1942 an all-time record of coke and byproduct supply was established by an increase in total production of approximately 7 percent over 1941, the previous record year. Even at this capacity rate of output the byproduct ovens were unable to meet all demands and beehive coke was supplied in larger quantities than in any year since 1925. The output of ammonium sulphate, benzol and toluol, the supply of tar and its derivatives, and gas production also made all-time records. The following table indicates preliminary estimates of 1942 production, based on Bureau of Mines monthly reports:

Byproduct coke......	62.2	million tons
Beehive coke.........	8.2	million tons
Ammonium sulphate..	1,535	million lb.
Ammonia liquor (NH_3)	68	million lb.
Tar	740	million gal.
Creosote oil..........	41	million gal.

Operations at all byproduct ovens will be maintained as close to capacity as possible during 1943 since only small increases in oven capacities are

expected to become available. Building of new ovens in the remainder of the war period is not anticipated because of the restriction on structural materials and equipment. The increase in blast furnace operations which goes on slowly but surely, will probably have to be met with still further increase in beehive oven coke.

Practically all of the ammonium sulphate and ammonia liquor from byproduct operations is consumed in supplying the bulk of the chemical nitrogen needs of the fertilizer industry. Relatively little synthetic ammonia can be used for fertilizer making because it is primarily required for the manufacture of explosives and other direct war supplies.

Production of toluol from the light oil made at coke works continues to flow almost exclusively to TNT plants. However, that supply is augmented by huge quantities made from petroleum, principally recovered as an incident to manufacture of high-octane gasoline.

New burdens on benzol suppliers developed during the past year, largely affecting methods for recovery at coke works and tar refineries. The new demand for supply originated in the requirements for styrene with which to make Buna-S rubber. Similar demands for xylol, naphthalene, phenol, and other tar acids or derivatives have been augmented by military needs. It is no military secret that unprecedented quantities of these coal-tar and light-oil derivatives have been made during the last year; and still greater quantities are desired in 1943.

POSTWAR REQUIREMENTS

Postwar requirements and activities at byproduct oven plants will depend directly on the needs for metallurgical coke. The decline in toluol requirements will probably not be an important factor affecting coke oven affairs in the postwar period.

The demand for benzol will depend on the synthetic rubber industry. Fortunately, if that benzol demand is not as great as the supply, there is always available a market as a blending agent for motor fuel. Unfortunately for the benzol maker, however, the price which he can expect as a blended-gasoline component is very low.

The post-war requirements for ammonium sulphate will be much less than the potential supply from ovens and synthetic plants combined. Thus the prospects are not too good for the byproduct manufacturer. The problems with respect to gas and tar disposal are discussed above where the trend in fluid-fuel competition is briefly presented.

Turpentine and Rosin

Production data for naval stores industry show that outputs of gum rosin and turpentine have been curtailed to comply with government conservation program but producers of wood products have steadily expanded operations.

PRODUCTION of naval stores for the crop year ended March 31, 1942, continued to feel the effects of the conservation program which calls for a reduction in output until surplus stocks have been used up. In the case of both turpentine and rosin a lower total was reported for the year. For turpentine the figure was 548,796 50-gal. bbl. and for rosin, 2,135,593 500-lb. bbl. For the preceding year the figures were 566,341 and 2,146,865 respectively. These totals do not indicate much of a change in the rate of operations but they include the output of both gum and wood products and the producers of wood rosin and turpentine are not a party to the conservation program. A breakdown of the figures shows that production of gum rosin dropped from 1,173,639 bbl. in the 1940–41 season to 989,638 bbl. in the 1941–42 period and in the same time the output of gum turpentine was cut from 343,938 bbl. to 285,050 bbl. On the other hand the new supply of wood rosin in the two-year interval was raised from 973,226 bbl. to 1,145,955 bbl. and that of wood turpentine from 222,403 bbl. to 263,746 bbl. For the first time on record, the output of wood rosin was greater than that of gum rosin.

The progress of the 1942–43 season may be computed from the details which have been given for the first half, taking in the period from April 1 to Sept. 30. During that time production of turpentine amounted to 339,436 bbl. of which 211,436 bbl. came from gum and 128,181 bbl. from wood. For rosin the total was 1,243,151 divided, 697,736 gum and 545,415 wood. In each case this represents an increase over the corresponding time in the preceding season although the gain in rosin output was due to gum producers as wood plants cut their yield from 561,385 bbl. to 545,415 bbl. Under normal conditions about 72 percent of the gum crop is turned out in the first half of the crop year but it is thought that this proportion will not hold good in the current season as weather conditions at times have been unfavorable and there also has been difficulty in maintaining a normal working force, hence the usual base for calculating the year's crop may not be workable, especially as receipts at the three principal distributing ports since Sept. 30 have fallen sharply below those of the like 1941 period.

Apparent consumption of turpentine in the crop year ended March 31 of last year is placed at 602,337 bbl. compared with 593,586 bbl. for the previous season. Stocks at the close of the period were 156,369 bbl. which was 53,541 bbl. less than were reported for 1941. In the six-month interval, Apr.—Sept. of last year, apparent consumption was 293,523 bbl.

Supply, Distribution and Carryover of Turpentine

	1942-43 (Apr.—Sept.)			1941-42 (Apr.—Sept.)		
	Total	Gum 50-gal. bbl.	Wood	Total	Gum 50-gal. bbl.	Wood
U. S. carryover Apr. 1	156,369	86,448	69,921	209,910	146,735	63,175
Production	339,436	211,255	128,181	307,173	194,915	112,258
Imports	Not available			7,571	7,571	....
Available supply	495,805	297,703	198,102	524,654	349,221	175,433
Less carryover Sept. 30	202,282	131,869	70,413	170,027	124,994	45,033
Appar. total consumption	293,523	165,834	127,689	354,627	224,227	130,400
Less exports	Not available			47,319	30,179	17,140
Appar. U. S. consumption	Not available			307,308	194,048	113,260

Supply, Distribution and Carryover of Rosin

	1942–43 (Apr.—Sept.)			1941–42 (Apr.—Sept.)		
	Total	Gum 500-lb. bbl.	Wood	Total	Gum 500-lb. bbl.	Wood
U. S. carryover Apr. 1	1,434,677	1,230,817	203,860	1,874,160	1,653,235	220,925
Production	1,243,151	697,736	545,415	1,223,802	662,417	561,385
Imports	Not available			1,426	1,426	....
Available supply	2,677,828	1,928,553	749,275	3,099,388	2,317,078	782,310
Less carryover Sept. 30	1,341,632	1,053,526	288,106	1,784,828	1,623,693	161,135
Appar. total consumption	1,336,196	875,027	461,169	1,314,560	693,385	621,175
Less exports	Not available			260,380	139,265	121,115
Appar. U. S. consumption	Not available			1,054,180	554,120	500,060

or a drop of 61,104 bbl. from the comparable total for the year before. Stocks also increased to 202,282 bbl. or a gain of 45,913 bbl. for the six months.

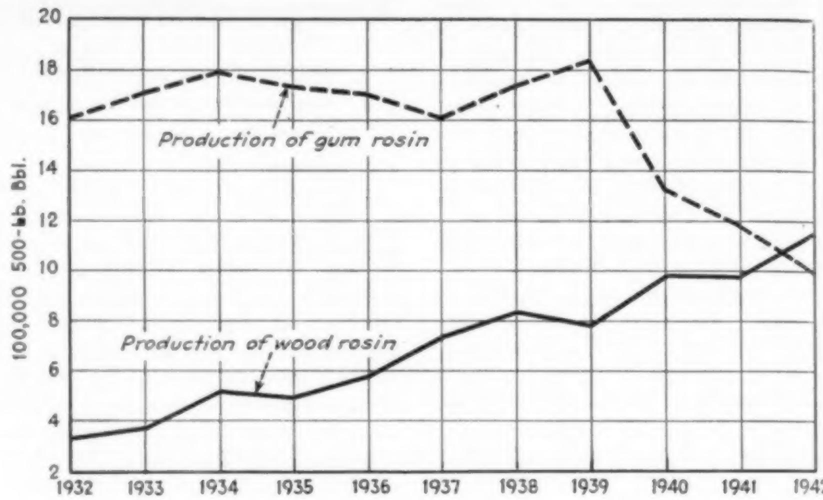
Consumption of rosin for the year ended March 31, was 2,575,076 bbl. as against 1,842,101 bbl. for comparable period of the preceding year and in the first six months of the current season the apparent usage was 1,336,196 bbl. as against 1,314,560 bbl. in 1941. The large carryover of 1,874,160 bbl. as of March 31, 1941 was reduced to 1,434,677 bbl. on March 31, 1942 and to 1,341,632 bbl. on Sept. 30, 1942.

In its report covering the first six months of this crop year, the Bureau of Agricultural Chemistry and Engineering includes the average monthly prices which prevailed in the Savannah market from April 1921 through Sept. 1942. For the 1921–22 season the yearly average for turpentine was 62.62c a gal. This rose to 119.82c in the following year and then almost continuously dropped year after year until 1938–39 when it stood at 22.61c a gal. From that time forward, the trend turned upward and the figure for 1941–42 was 63.85c. For the first half of 1942–43 the average worked out at 63.41c.

Prices for rosin are an average for all grades from B through WW and X and the high point shown is for the 1926–27 season when the average was $12.20 per 280-lb. bbl. The low level was reached in 1932–33 with a drop to $2.83 a bbl. The price movement then was upward and the average for 1937–38 was $7.35 a bbl. The trend again reversed and the 1941–42 level was $4.55 but the first half of 1942–43 saw a better market with sales prices averaging $6.98 a bbl.

Foreign trade in naval stores is now a confidential matter so far as export or import statistics are concerned but details have been given regarding buying for lend-lease and it is possible to state that export shipments have reached a fairly large total. Domestic consumption of turpentine and rosin may suffer some curtailment in the present calendar year if estimates for a smaller production of paints and varnishes prove to be true. On the other hand there is the probability that the government objectives for production may not be met because of shortage of labor in the gum branch of the industry.

The loan and purchase program will be continued through December. The rates will be equal to 90 percent of last Nov. 15 parity price. For rosin the rates will vary from $3.70 per 100 lb. for grade X to $3.25 for grade G, grades below G not being eligible for the loan. For turpentine the loan rate is 64c a gal. bulk. Loan and government-owned stocks at the end of 1942 amounted to 815,662 bbl. and drums of rosin and 140,320 bbl. of turpentine. At the end of 1941 similar stocks were 800,295 bbl. and drums of rosin and no turpentine.



The Foreign Commerce Weekly recently contained an article in which it touched upon the use of naval stores in war. The article stated that at present the paint and varnish manufacturers of the United States are doing war work. At least 50 percent of their output is exclusively for the armed forces, and the volume is growing every day. Paints and varnishes, which use turpentine in tremendous volume, are used for every conceivable kind of war production. Protective coatings are needed on tanks, in the manufacture of hand grenades, ammunition boxes, helmets, and practically everything else of durable character. Nearly every American shell that wings its way into the enemy ranks is coated with wax and rosin.

America's airplane production needs thousands and thousands of barrels of varnish, and the specifications that have been adopted by the Air Corps for aircraft varnish cannot be made without the use of rosin.

Modern products such as vinsol resin, special core binders for foundries, hydrogenated resins, special terpene hydrocarbons and alcohols, new-type rosin esters, and others now really put naval stores into double harness with our industrial war efforts.

In the textile field another pine-stump product is smashing a difficult bottleneck. It has been found that a

Reported Consumption of Rosin

	1942–43 (Apr.-Sept.) 500-lb. bbl. Total	1941–42 Apr.-Sept. Total
Abattoirs	188	519
Adhesives & plastics	11,687	12,590
Asphaltic products	2,646	1,008
Automobiles & wagons	139	332
Chemicals & pharmaceuticals	114,017	71,818
Ester gum & synth. resins	73,536	116,054
Foundries & f'dry supplies	15,230	11,719
Furniture	109	4
Insecticides & disinfectants	2,596	2,991
Linoleum & floor covering	24,319	7,490
Matches	790	531
Oils & greases	17,245	35,665
Paint, varnish & lacquer	73,631	128,605
Paper & paper size	176,198	209,598
Printing ink	7,994	9,024
Railroads & shipyards	1,990	3,699
Rubber	1,404	4,768
Shoe polish & shoe materials	3,569	6,152
Soap	125,250	126,240
Other industries	7,016	3,569
Total industrial reported	659,554	752,376
Not accounted for[1]	[2]	301,804
Apparent U. S. consumption	[2]	1,054,180

[1] Principally unreported distribution of rosin through retailers who sell in small quantities to ultimate consumers.
[2] Not available.

Reported Consumption of Turpentine

	1942–43 (Apr.–Sept.) 50-gal. bbl. Total	1941–42 (Apr.–Sept.) Total
Abattoirs	9	0
Adhesives & plastics	313	305
Asphaltic products	0	0
Automobiles & wagons	103	244
Chemicals & pharmaceuticals	33,570	31,907
Ester gum & synthetic resins	0	0
Foundries and f'dry supplies	466	546
Furniture	170	269
Insecticides & disinfectants	49	204
Linoleum & floor covering	16	0
Matches	0	0
Oils & greases	14	145
Paint, varnish & lacquer	16,970	29,090
Paper & paper size	0	0
Printing ink	109	110
Railroads & shipyards	4,765	3,763
Rubber	56	76
Shoe polish & shoe materials	4,790	4,424
Soap	0	0
Other industries	141	216
Total industrial reported	61,532	71,299
Not accounted for[1]	[2]	236,009
Apparent U. S. consumption	[2]	307,308

[1] Principally unreported distribution of turpentine through retailers who sell in small quantities to ultimate consumers.
[2] Not available.

special type of pine oil, added to the soap-soda ash mix in the fulling machines, can cut the time required for fulling by a third on heavy OD woolens, and reduce it on lighter weaves.

The rubber situation, currently another worry in our national war effort, is being favorably affected by pine stumps. The use of reclaimed rubber is becoming more and more important, and one of the terpene hydrocarbons is an excellent softener for the rubber and is therefore valuable in the reclaiming process.

Within the newly developed group of rosin esters are other new materials with properties that will probably prove equally valuable.

Esters and various reagents are a far cry from the original products, pitch and tar, used to caulk wooden ships and preserve their rigging. Now, with the application of modern technology to this ancient chemurgic art, a whole host of new and important uses opens up. Naval stores again becomes as vital in war as they were three centuries ago.

Pulp and Paper

Heavy overstocking by consumers in the latter part of 1941 forced pulp and paper mills to record rates of operation. Early in 1942 these accumulations served to restrict new business and production started on a downward trend.

ALTHOUGH the usual census of manufactures for 1941 was not taken, the Bureau of the Census did make a survey of pulp and paper production for the War Production Board. The figures as given for 1941 are not strictly comparable with those for preceding years because the totals are affected to some extent by the inclusion in the latest survey of statistics for a few companies not hitherto covered.

Production of woodpulp in 1941 reached the all-time high of 10,200,726 tons which represented a gain of almost 14 percent over the 8,959,559 tons reported for the preceding year. Based on data for monthly production as reported in the Survey of Current Business, production of pulp was about the same in 1942 as it had been in 1941. For 1941 the output of sulphate pulp was 4,394,338 tons while in 1942 it was approximately 4,625,000 tons. A slight gain also is indicated for production of sulphite pulp last year as the output was around 2,930,000 tons as compared with a figure of 2,918,780 tons for 1941. Soda pulp made a less favorable showing with a probable drop of close to 25,000 tons from the 1941 total of 617,012 tons.

The monthly statistics for paper production do not give the same classifications as are contained in the census report and it is not possible to make comparisons for the two years. The Department of Commerce has reported production of paper board for 1942 at 5,800,456 tons against 6,142,290 tons for 1941.

Production of pulp has been relatively higher than that for paper because the drop in receipts of foreign pulp had to be made up by increased domestic output. It is expected that a part of the business which formerly went abroad will be kept at home even when ocean shipments are again made available.

What may be expected in the way of activity at pulp and paper plants in the current year is largely a matter of how much government control is to be exercised over production and distribution. The War Production Board early in the year amended its conservation order.

In a statement presenting the order as amended, the Pulp and Paper Division of WPB pointed out that the order as originally issued was "designed to prevent a runaway market pending the development of a more scientific program geared to requirements. It 'froze' a number of mills and the production of certain grades of paper at low levels. Specific hardships have been relieved through appeals, without relation, however, to any general objective.

Meanwhile shortages of labor, trucks and tires in the woods have increased, heralding a decline in the production of wood pulp for paper, from the current rate of 10,500,000 tons per annum to a rate by the middle of 1943 estimated to be about 8,500,000 tons. This, together with increasing estimates of requirements, renders imperative a new program.

Under the previous form of the order, the production of paper and paperboard was running at the rate of approximately 3,800,000 tons per calendar quarter, as the total for all types. Under the order, as now amended, production of the tonnage permitted for the first calendar quarter of 1943 is estimated to be approximately 4,100,000 an increase of 8 percent.

This increase is required in order to permit expanded production of those grades containing waste paper and other waste or non-fibrous material. It is only a temporary measure to allow increased production in these grades pending balancing reductions in other grades.

Important specific provisions under the order as now amended are as follows:

No production in any mill which has not been in production since August 1, 1942, without specific authorization by the Director General for Operations.

(2) Each mill is required each quarter to calculate its quarterly production quota by applying various percentages (between 80 and 100) to its production of each of the major classes of paper during the six months ending March 31, 1942.

In general each mill's production is limited each quarter to its quota thus calculated, but a mill may produce within that quota any grade or grades desired, regardless of what it produced during the base period, provided the aggregate does not exceed the quota. In addition any mill may, over and above its quota, produce any quantity of any of several named grades especially needed.

Paper requirements for war and essential civilian use were discussed at a meeting of the Pulp and Paper Industry Advisory Committee in January. Members were told that the latest estimates from the Divisional Requirements Committee on war and essential civilian use requirements for paper and paperboard indicated that these products would be needed at an annual rate of approximately 14,300,000 tons. It was explained to committee members, however, that this figure is tentative only.

On the basis of the estimate of 14,300,000 tons the following three problems face the industry: (1) to reduce paper production to that level; (2) to keep it at that level as time goes on and expected raw material shortages threaten to reduce production below that figure; (3) to insure proper distribution of the paper produced in line with end use limitations.

Committee members also discussed the seven new orders affecting the consumption and production of paper. Government officials explained to members that Order M-241 as amended, which governs production of paper, is only a first step, and that production will be reduced in line with expected reduction of consumption.

Consumption of Chemicals

Domestic industries consumed chemicals last year in record quantities with war and lend-lease requirements adding heavily to usual outlets. Production totals likewise reached a new high with practically all offerings meeting an immediate market which prevented any large accumulation of stocks.

Both production and consumption of chemicals last year were pushed far beyond anything that had been previously recorded for the industry. The increase in output apparently approximates 23 percent over the total reached in 1941. With no accurate figures covering export trade and shipments out of this country on a lend-lease basis, it is difficult to estimate how much of domestic production was consumed at home. The *Chem. & Met.* index for consumption indicates a gain for the year of about 6 percent in industrial lines which do not include the chemicals that went directly into war goods. One of the main factors in expanding the use of chemicals is found in the rising outputs of munitions a good part of which are of chemical composition. The Department of Commerce in commenting on this stated that growth of munitions production throughout the year was steady. In November this production had reached a rate approximately four times that of a year earlier. Adjustments to bring about better balance in the entire munitions program and to take account of the growing scarcity of materials were associated with the decline in the rate of growth during September and October but the Bureau says production in November once more shot ahead to register the largest monthly increase yet recorded. What this meant in terms of chemical demand may be inferred by noting that the index for munitions manufacture, November 1941 equalling 100, stood at 163 in January 1942 and at 382 in October 1942.

In addition to the munitions program, other branches of direct production of war goods had a bearing on the movement of chemicals. Announcement on our war production for last year revealed that just before our entrance into the war, domestic aluminum supply was at the rate of 917,200,000 lb. a year whereas at the end of last year it had risen to a rate of 2,300,000,000 lb. a year. The prewar rate for output of magnesium was reported at 42,000,000 lb. a year and at the end of 1942 it was at the rate of 260,000,000 lb. The growth in output of these two metals was in itself enough to exert an influence on the chemical industry. War expenditures on the part of the Government included a wide variety of products but the majority of them required chemicals somewhere in their manufacture or processing. Hence there is considerable of chemical significance to the financial statement which records war expenditures last year at more than 52 billion dollars as compared with disbursements of less than 14 billion dollars in the preceding year.

These expenditures showed a progressive growth throughout the year, jumping from 2,193 million dollars in January to 6,125 million dollars in December. Plans for 1943 call for this growth to be further accelerated. It is evident, therefore, that industry has been going through a period where unprecedented rates of manufacturing have taxed the raw material supply of the nation and the customary flow of materials has been forced to give way to directional supervision in order that more essential finished products might be made available. Hence, while there has been a sharp increase in consumption of chemicals, this increase has not been spread proportionately among the various consuming industries. In fact the concentration upon products most useful in the war work has had the very definite effect of slowing up many manufacturing lines. To a certain extent this accounts for the difference between the rate of gain for consumption of chemicals as measured by the *Chem. & Met.* index and for production as defined by the index of the Federal Reserve Board. The greater part of this difference, however, is due to the fact that the consumption index, based on peacetime activities, has not been adjusted to respond to the influence of the new war industries.

Considering the rate at which all industry operated last year, the use of chemicals in the regular channels was relatively low, being but little higher than in 1941. Higher operating rates in some lines were partly offset by reductions in other directions with the overall result indicative of a leveling off around existing levels.

Conditions necessarily vary in the separate industries. For example, fertilizer production was stepped up in compliance with the government request for larger agricultural crops. Some substitution of fertilizer chemicals was necessary chiefly to replace the anhydrous and aqua ammonia usually available but for which more pressing need was found elsewhere. Other materials were present in ample volume and the industry carried out its assignment in an adequate way. For 1943, food requirements for use at home and for shipment abroad are larger than ever before. This calls for larger acreages and larger consumption of fertilizer so that a record year for the latter seems in prospect.

Pulp and paper mills were very active at the beginning of last year but this situation changed before the year had advanced far. In the preceding year consumers had stocked up heavily and buying interest had been so keen that production schedules were

CHEM. & MET'S WEIGHTED INDEX FOR CONSUMPTION OF CHEMICALS BASED ON

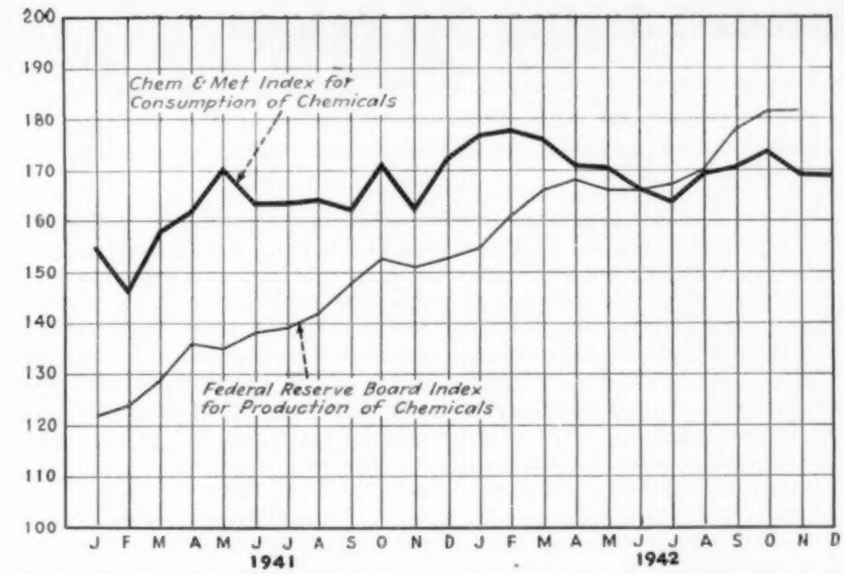
	1942											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Fertilizer	37.91	35.72	37.58	34.21	34.60	35.04	35.08	38.75	40.22	38.50	40.11	40.30
Pulp and paper	23.30	21.30	23.35	22.42	21.06	19.40	17.72	18.70	19.06	20.55	20.11	19.30
Glass	16.60	15.18	16.65	16.70	16.88	16.06	14.54	15.76	15.30	15.90	14.61	14.87
Petroleum	15.57	13.19	14.51	13.70	13.97	15.65	14.42	14.88	14.70	15.21	15.20	16.10
Paint, varnish, and lacquer	15.28	14.67	15.61	16.40	15.97	14.27	13.70	13.60	13.97	14.32	12.38	12.06
Iron and steel	13.45	12.03	13.52	13.13	13.73	13.27	13.58	13.39	12.99	13.81	13.28	13.60
Rayon	15.10	13.33	15.24	14.68	14.97	14.89	15.30	15.17	14.89	15.20	14.91	15.46
Textiles	12.07	11.35	12.20	12.24	11.95	12.26	12.37	11.64	12.00	12.32	11.61	11.58
Coal products	9.78	8.74	9.80	9.51	9.98	9.52	9.59	9.58	9.39	9.68	9.38	9.52
Leather	5.30	5.02	5.10	4.97	4.90	4.80	4.64	4.67	4.70	4.95	4.75	4.70
Industrial explosives	5.36	5.49	5.22	5.99	5.91	6.15	5.80	6.08	6.21	6.04	6.05	4.47
Rubber	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
Plastics	4.40	3.80	4.60	4.43	4.20	4.25	4.40	4.30	4.45	4.60	4.40	4.50
	177.12	162.84	176.38	171.38	171.12	166.56	164.14	169.52	170.88	174.08	169.69	169.46

advanced sharply. As this buying interest failed to continue, production dropped off accordingly and for the greater part of the year was below the 1941 level. The outlook for 1943 is even less promising. Consumers of paper are cutting their requirements by 10 percent in the first quarter and further cuts will be made as the year progresses.

Glass makers have been in a favorable position for the last two years. In the first place, the more important raw materials needed in the manufacture of glass are readily available with no strings attached to their use. In the second place, the shortage of metals has turned a large part of packaging requirements to glass manufacturers. To meet this additional demand, container plants have been pushed to near-capacity and an all-time record for output was made in the last twelve months. The immediate future, going ahead at least to the time when the metals markets return to normal, should see a continuance of this condition. The nearby outlook for flat glass is none too bright. Plate glass has been in a slump from the time production of automobiles was cut down and apparently will stay there until automotive production has been restored. Window glass has been making a good record but the large private and government construction programs are coming to a close and there is nothing in sight to replace them.

Paint and varnish is in a position much similar to that reported for flat glass. The sale of lacquers has suffered from automobile curtailment and the poor prospects for building forecasts a reduced demand for paints and varnishes in the present year. Restrictions on materials have been pretty well taken care of by the development of substitutes and the unfavorable outlook is not due to the existence of allocations or restrictions but rather to the probability that war-work demands will not make up for the loss incurred in industrial fields.

The plastics field is one which has aroused more comment perhaps than



any other because wherever a shortage of any kind came to light some one immediately suggested that the hole might be plugged through the use of plastics. The adaptability of plastics for use in a wide variety of fields has taxed the ability of producers to turn them out in sufficient volume. Moreover, the Government has taken over entire outputs of some types and is a large user of others. The amounts made available last year must have shown a marked rise over the 1941 output but production data are shrouded in secrecy and the numbers used in the index for chemical consumption were based on private and trade estimates in the absence of all official figures.

In the textile industry, there has been an almost total disappearance of silk as a raw material but other fibers were made use of in a large way last year and the combined output of textiles was of record proportions. Military requirements took a sizable share of cotton and woolen goods and if plans for increasing the number of men under arms, are carried out as now expected, the armed forces will continue to contribute heavily to the activity of mills. Despite the recurrence of rumors to the effect that civilian use of textiles would be held under control, the raw material situation would not make any such action necessary. The supply of cotton is large enough for all needs and a large reserve of wool has been accumulated. In fact opposition has been expressed against the taking over of the new wool clip by the Government on the ground that the centralized holding of such large stocks would be a dangerous price factor if the war should come to a sudden end.

Rubber has attracted attention more from the standpoint of proposed supplies of synthetic, yet last year's operations were largely concerned with the use of natural and reclaimed. Stockpiles of natural were drawn upon for permissible manufactures and to a certain extent to supply some foreign wants. Capacity for reclaiming rubber was expanded and was utilized in a large way. In the present year, synthetic production will make progress although not to the extent as had been originally planned but in the latter part of this year this branch of the industry should offer a very worth while market for chemicals which will grow as the rubber program gathers speed and which sometime in the future will meet the test of survival when natural rubber attempts to recapture its markets.

PRODUCTIVE ACTIVITIES IN PRINCIPAL CONSUMING INDUSTRIES, 1930–1942

1930	1931	1932	1933	1934	1935	1936	1937	1938	1939	1940	1941	
26.40	18.53	11.64	17.78	18.91	19.47	22.57	28.93	23.72	25.13	28.80	31.49	Fertilizer
11.46	10.71	9.34	10.80	11.15	12.39	14.31	15.96	13.70	16.52	19.98	21.92	Pulp and paper
9.31	8.00	6.03	7.71	8.21	10.58	12.45	13.61	9.00	12.51	13.15	15.03	Glass.
10.11	9.77	8.93	9.37	9.74	10.51	11.61	12.87	12.68	13.45	14.08	15.20	Petroleum
10.40	8.62	5.96	6.80	8.54	10.35	10.77	11.33	9.47	10.66	11.12	15.03	Paint, varnish, and lacquer
7.53	5.56	3.10	4.46	5.43	7.20	8.00	9.21	5.87	8.21	10.54	12.88	Iron and steel
3.07	3.65	3.29	5.23	5.09	6.29	7.01	7.97	5.82	9.08	11.43	12.87	Rayon
5.38	5.62	5.13	6.40	5.52	6.11	7.44	7.62	6.14	7.89	8.52	11.08	Textiles
7.32	5.23	3.58	4.22	4.88	5.74	7.46	9.66	5.37	7.17	8.91	9.28	Coal products
3.32	3.25	3.11	3.55	3.65	3.95	4.08	4.10	3.35	4.16	3.96	4.88	Leather
5.17	3.97	2.76	3.04	3.74	3.62	4.60	4.71	3.89	4.53	4.91	5.54	Industrial explosives
2.02	1.58	1.57	1.86	2.10	2.17	2.58	2.56	1.86	2.79	3.05	3.91	Rubber.
.78	.82	.64	.78	1.09	1.62	1.97	2.28	1.30	2.05	2.77	3.71	Plastics
102.29	85.31	65.08	82.00	88.05	100.00	114.85	130.81	102	124.15	141.22	162.80	

Upward Swing To Prices

Although controls were largely in effect the trend of prices for chemicals and oils and fats was rather sharply upward particularly for oils because some of them had not been placed under ceilings and supplies were very low.

Prices for chemicals have been on a firm foundation from the time war was declared in Europe. Domestic markets immediately felt the influence of a quickened buying movement. Export inquiry became very active and this applied not only to chemicals themselves but also to finished products which contain chemicals. Later the defense program acted to stimulate buying interest and finally the superimposing of a newly-created war industry upon general industry developed a market for chemicals which could not be satisfied by existing productive capacities even though they had been enlarged to a considerable extent. Naturally, preference had to be given to requirements for goods of military importance and less essential needs were practically placed on a quota basis. In short, total supply of chemicals was inadequate to meet total demands. This explains the present price position.

In addition to the workings of the law of supply and demand, the price tone for many chemicals last year was further strengthened by the fact that some of the raw materials commanded higher prices, freight rates added to the cost of materials at delivered points—this being especially true where water transportation was cut off and all-rail deliveries had to be made. Also cases were reported where, in order to attain greater output, efficiency of operation was sacrificed.

The higher average level of chemical prices last year, however, was not due to a steadily rising market throughout the year but rather to the establishment of sales schedules at the beginning of the year which showed a marking up for some of the fairly large tonnage products. Starting from this point, the month to month fluctuations were very minor. Toward the close of the year, contract prices for 1943 delivery were repeated for the majority of chemicals and there is reason to believe that with the controls now in effect, a point of stabilization has been reached which will continue over the current year. The controls serve as a guarantee that very little if any upward price movements will follow and the narrowed profit margin caused by higher production costs should stand in the way of any reductions.

Looking ahead to the contracting season in the latter part of the year, some price adjustments may be in order. Prospective plans for industrial output—military and otherwise—indicate a material gain over the 1942 total. This will be made possible in part by cutting civilian requirements to a minimum but also will demand a larger supply of raw materials including chemicals. This widening disparity between available supplies and potential consuming demand may make it advisable to stimulate some production by waiving price controls.

Values for oils and fats had begun to spiral in the latter part of 1941 and the upward swing was in evidence over the first half of last year reaching its peak in May. Higher prices were distributed over most of the oils and fats including crude cottonseed, linseed, corn, China wood, and soybean. Fish oils also were held at higher figures.

Reasons underlying the strong price position of oils and fats were very similar to those reported for chemicals—a preponderance of demand over supply. Due to the practical elimination of Far Eastern oils from our markets, greater reliance had to be placed on domestic oil-bearing materials and continental sources of supply for oils and oilseeds were thoroughly explored with the result that South America furnished a wider diversity of oils than in any preceding year.

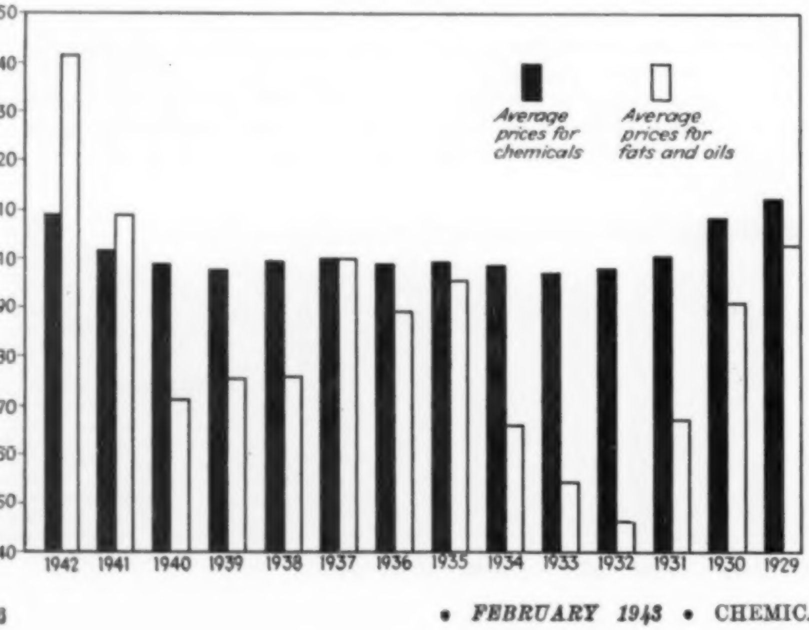
In addition to the rise in demand for oils in the usual industrial channels, domestic and lend-lease calls for edible oils and edible products made from oils, resulted in a move to increase outputs of edible oils at the expense of the non-edible oils. In the case of linseed oil, prices have been dictated to a certain extent by the course of the seed markets in the northwest and in the Argentine. A factor of still greater influence, however, was the lack of shipping space to move Argentine seed to Atlantic ports and the curtailment of crushing operations which resulted.

Average Yearly Prices for Chemicals and Oils and Fats, 1929-1942

	Chemicals	Oils and Fats
1942	109.22	141.27
1941	101.69	109.24
1940	98.90	71.22
1939	97.64	75.42
1938	99.86	75.93
1937	100.00	100.00
1936	98.81	89.40
1935	99.64	95.60
1934	98.74	66.09
1933	97.10	54.20
1932	97.91	46.50
1931	100.55	67.14
1930	108.60	90.82
1929	112.32	102.74

In September the Commodity Credit Corp. offered contracts to refiners of cottonseed, peanut, and soybean oils whereby they might purchase crude oils at specified prices, this oil to be sold to CCC at the same levels and then resold to refiners at a reduction of one-half cent a lb., thus practically subsidizing refiners to the extent of the reduction. The prices specified for crude cottonseed oil ranged from 12¼c to 12¾c a lb. depending on point of shipment; peanut oil 12⅞c to 13c; and crude soybean from 11¾c at midwestern and southern mills to 12¼c a lb. at Pacific Coast points.

Around the middle of November, the Office of Price Administration issued an order authorizing sellers of refined cottonseed, peanut, and soybean oils to advance their ceilings by ½c a lb.



Industrial Waste Disposal

F. W. MOHLMAN

Director of Laboratories, Sanitary District of Chicago, and Editor of Sewage Works Journal

Chem. & Met. INTERPRETATION

In wartime, industrial wastes disposal takes on a new significance. This is particularly true in the process industries for many of them have been expanded tremendously and new ones presenting new problems have come into being. The wastes from many of these industries, including munitions plants, are discussed in this second of two articles based on the paper Dr. Mohlman presented in Chicago during the second National Chemical Exposition. In the article in the January issue emphasis is on sewage and byproduct recovery.—*Editors.*

The industrial waste problem has far greater ramifications than the sewage disposal problem. The review of what has been attempted or accomplished in salvage from sewage shows that progress has been made along lines of conservation, even though profits cannot be claimed nor spectacular accomplishments recorded. However, industrial waste salvage offers more opportunity for success, because of the far greater value of the materials handled, in most cases, and the greater concentration of solids in the waste liquors. Sewage never contains more than 0.1 percent solids, whereas industrial wastes may contain up to 5 percent solids, or even more, as they are discharged within the plant.

The magnitude of the industrial waste problem has been reported by the National Resources Committee. In 1939, it was estimated that the cost of treatment of industrial wastes throughout the United States would amount to approximately $700,000,000. The build-up of this estimate is shown in Table I, in which the cost of installing treatment plants for the food industry was estimated to be 205 millions, paper 129 millions, textiles 54 millions, and others lesser amounts. The total was practically as much as is needed to complete all further sewage treatment in the U. S.

A recent survey, on a more intensive basis, of the Ohio River Basin by the U. S. Public Health Service, has shown that industrial wastes reaching that river, have a population equivalent (p.e.) of nearly 10,000,000. These results are shown in Table II. "Population equivalent" is based on the 5-day biochemical oxygen demand; one person requires 0.167 lb. per 24 hr.

The predominance of chemical and paper wastes is noteworthy. The great concentration of organic chemical industries in West Virginia, is responsible for most of the former, and the paper mills in Ohio for the latter. The population equivalents for milk and meat packing plants appear low. Distilling wastes are very important.

For the past seven years, an extensive survey has been made of industrial wastes in the Sanitary District of Chicago (S.D.C.) At least two weeks were spent at each plant, and nearly 300 were included. Weirs were built in the outfall sewers, automatic flow gages installed, samples collected every 15 minutes, day and night samples composited in proportion to flow, and analyses made of the composite samples. Two weeks' records were compiled, corrected for Sunday results, and average pounds of suspended solids and biochemical oxygen demand discharged per 24 hr. computed. The industries were then classified in 24 types and the results summarized, as shown in Table III.

The total flow of 93 million gallons per day is low compared with the total flow of human sewage to the treatment plants of the S.D.C. of 1,000 m.g.d.; 172 tons of suspended solids are a sizable proportion of the 400 tons per day from human sewage; and the population equivalent of 2,700,000 is a large factor when added to the human population of 3,960,000.

The outstanding importance of the packinghouse industry in Chicago is shown in Table III. The total p.e. for food products, yeast and vinegar, malting and breweries is 659,200 or almost as much as for packinghouses, but the suspended solids are much less. On the other hand, tanneries and paper mills contribute a large tonnage of suspended solids. Dairies and laundries have been placed in a special category at the bottom of the list because of the question as to whether they should be considered as industries. However, the flow and the p.e. of laundries are higher than might be expected.

Having oriented the national, regional and municipal types of wastes

Table I—Industrial Wastes in the United States—Estimated Cost of Treatment

(National Resources Committee, 1939)

Type	Millions of Dollars	
Foods and beverages		
Milk products	32.6	
Canneries	22.4	
Distilled liquor	10.4	
Malt beverages	41.0	
Meat packing	30.0	
Cereal preparation	30.0	
Beet sugar	7.6	
Total		205.4
Chemicals		28.3
Gas and petroleum		35.0
Textiles		54.0
Ferrous metals		20.0
Non-ferrous metals		21.6
Paper		129.0
Rubber goods		1.0
Sub-total		494.3
Miscellaneous and contingencies		200.0
Grand total		694.3

Table II—Industrial Wastes in Ohio River Basin

Industry	No. Plants	Sewered Pop. Equiv.
Brewing	38	264,300
Byproduct coke	23	745,200
Canning	218	758,900
Chemical	65	1,880,400
Distilling	67	1,009,700
Meat	173	385,700
Milk	253	85,100
Oil refining	47	116,500
Paper	59	1,659,200
Steel	174	(a)
Tanning	32	269,600
Textile	122	335,100
Miscellaneous	333	160,300
Total	1,604	7,670,000
To city sewers	......	2,304,300
Grand total	......	9,974,300

(a) 168 tons free acid discharged daily in waste pickle liquor.

Table III—Survey of Industrial Wastes, The Sanitary District of Chicago, 1935-1942

No.	Type of Industry	Flow, M.G. 24 Hr.	Suspended Solids, Tons 24 Hr.	Pop. Equiv.
1	Packinghouse and stockyards	26.30	62.98	734,000
2	Meat products and sausage casings	1.72	4.28	73,700
3	Rendering works	0.30	1.11	28,400
4	Glue and gelatin	3.76	10.75	137,000
5	Food products	3.56	7.48	204,000
6	Yeast and vinegar	2.48	3.43	194,100
7	Malting	1.82	1.55	77,100
8	Breweries	2.72	9.12	184,000
9	Tanneries	2.27	17.70	111,700
10	Soap	1.84	1.34	43,400
11	Vegetable oils	4.15	2.85	62,400
12	Candy	4.00	1.66	93,100
13	Textiles	1.14	3.36	44,700
14	Paper	5.95	10.05	67,300
15	Coke plant and tar products	4.05	4.18	105,700
16	Pharmaceuticals	0.60	0.54	22,300
17	Dye works	0.12	0.06	1,800
18	Chemicals and viscose casings	3.66	5.62	59,600
19	Steel and iron pickling	1.30	2.53	....
20	Brass, copper, minerals	5.51	5.69	....
21	Rubber, asbestos, enamel	1.96	0.95	2,500
22	Miscellaneous	1.92	1.01	11,200
23	Dairies and milk products	4.11	6.28	144,700
24	Laundries	7.74	7.36	294,000
	Total	92.98	171.88	2,696,700

and their relative importance, we are ready to discuss specific problems and the relation of such problems to the war economy, wherever we find the influence of war impressed upon particular industries.

For some years the writer has studied the problem of reducing the pollutional potency of wastes from the production of organic chemicals such as dyes, pigments, intermediates, and detergents. It is of first importance to concentrate on the processes that produce wastes of greatest population equivalent, from the standpoint of B.O.D. (oxygen demand) or suspended solids. Inert mineral solids such as calcium carbonate, calcium sulphate or magnesium hydroxide are not nearly so objectionable as organic sulphur compounds, nitrogen-containing residues or soluble carbohydrates. It requires an experienced analyst to determine the B.O.D. of organic chemical wastes, many of which are germicidal in concentrated solution but which have a considerable oxygen demand in dilute solution when seeded with bacteria.

When the bad actors, from the standpoint of pollution, have been listed, intensive study should be concentrated on the problem of salvaging some sort of solids from the mother liquors. Possible recoveries from batch operations are sulphur, sulphur dioxide, spent acids, solvents, alcohol, metallic salts and pigments. Continuous processes of the catalytic or fractionating type may be "bottled up" by recirculation of water used for condensers or absorbers, with resultant concentration of solids in the recirculated liquid to the point where they can be recovered, possibly with profit. If unprofitable, at least the pollution load can be greatly reduced.

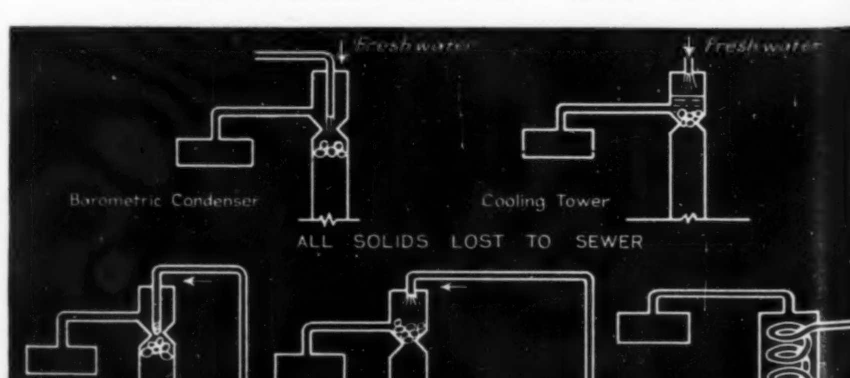
The principle of recirculation of condensing water is important in the entire field of industrial waste salvage. It has been found of value in a number of industries—corn products, paper mills, byproduct coke and organic acids, and possibly in distillation of fatty acids, concentration of tomato products, and any process of concentration of organic solids which contain volatile solids. Changing from once through to recirculation always involves considerable study to determine whether the product will be affected, how much make-up water will be needed, or whether some chemical treatment of the recirculated liquid may be required, but once these problems are worked out and the recirculation is adopted, either valuable byproducts are recovered or a great decrease in pollution is effected. This principle is one of the most important and effective in the entire field of waste prevention.

An important problem of waste disposal, as related to war economy, is the disposal of wastes from TNT works. The waste waters are of two main types, one the acid or yellow water, and the other alkaline or red water. These liquors are odorless and have no B.O.D., but both, particularly the red waste, have intense colors which persist into high dilution. All usual methods of treatment such as chemical precipitation, biological treatment and adsorption by activated carbon are unsuccessful, and only chlorination, evaporation or dilution remain as possible methods of disposal. Chlorination greatly reduces the color of the acid mixtures, but chlorine is hard to get now, even for munition works. This leaves only evaporation or dilution.

Evaporation was and is an expensive process, costing several thousand dollars per day, and requiring critical equipment such as quadruple-effect evaporators and kiln dryers, in addition to large amounts of caustic soda. In spite of this, facilities for evaporation were being installed at all TNT plants, without reference to the dilution capacity of the stream into which the wastes were discharged.

Investigations showed that the required dilutions could be determined, with the various river waters into which wastes were discharged, beyond which there would be no harm to water supplies from color and taste. Other requirements, such as freedom from toxicity to fish and human beings and freedom from acidity, could be obtained at considerably lower dilutions than those necessary to eliminate color, and therefore the prob-

Principle of recirculation for recovery of soluble materials



lem was to determine the maximum color permissible in the river, corresponding to a certain flow in cubic feet per second. With flows lower than this minimum, wastes must be stored and later discharged at higher stream flows.

Studies were made of dilutions with water from the Missouri, Ohio, Illinois, Susquehanna, Niagara and several others, and minimum dilutions specified. This resulted in elimination of several evaporation units and the transfer of one unit to a TNT plant where it was needed because of the almost negligible dilution available. As each of these evaporation plants costs over one million dollars, the saving was considerable.

This development has been an impressive example, in which rivers have been utilized to dispose of wastes, whose disposal otherwise would require critical materials and large expenditures.

The staggering population equivalent of 28,800,000 indicates the enormous load of pollution that might reach our streams from the alcohol industry if measures were not taken to utilize still slop

The W.P.B. 1943 quota for alcohol is 530,000,000 gal., of which 240,000,000 is to come from the distilled spirits industry, 225,000,000 from the industrial alcohol industry, and the remainder from the synthetic process using refinery byproducts. This quota of 465,000,000 gal. from fermentation processes carries with it the necessity of disposing of the still slop by feeding, evaporation or other means of disposal, because the pollutional equivalent of such an enormous volume of still slop would constitute a load that would tax the assimilative capacities of even our largest rivers. According to the U. S. Public Health Service, 5,000 gal. per day of 100-proof spirits (50 percent alcohol) produces still slop with a population equivalent of 60,000. The quota of 465,000,000 gal. of 95 percent alcohol is equivalent to 883,500,000 gal. per year, or 2,400,000 gal. per day, of 100-proof spirits. The p.e. for still slop from this production would be $2{,}400{,}000/5{,}000 \times 60{,}000 = 28{,}800{,}000$.

This p.e. discharged into our streams would be calamitous. The total sewered population of the United States is 70,506,000 and therefore if the still slop from the total projected fermentation alcohol production in 1943 were discharged untreated into our streams, the pollution produced would be equivalent to 41 percent of the total sewage discharged into sewer systems and thence to streams, lakes or harbors.

This staggering p.e. of 28,800,000 indicates the enormous load of pollution that might reach our streams from the alcohol industry if measures were not taken to utilize still slop. Possibly some of the vacuum evaporators used in one or two TNT works might be diverted and used to concentrate still slop, thus recovering a foodstuff for stock, whereas now the incinerated solids from TNT wastes are flushed to the nearest stream.

The S.D.C. has made probably the most complete survey of brewery wastes on record. Some 28 breweries were investigated, with losses as shown in Table II. The p.e. was 184,000 and the loss of suspended solids 9 tons per day. The average results showed a loss to the sewer of 1.7 lb. suspended solids per barrel of beer. In 1938, 51,360,000 bbl. of beer were produced. Losses of suspended solids to the sewer therefore amounted to 43,600 tons per yr., or approximately 120 tons per day, from all breweries in the U.S. The p.e. found in the Chicago studies was 18.6 per bbl. of beer. This pro-rated for all breweries in the U. S. would give a p.e. of approximately 26,000,000. This indicates the high organic content of these wastes and the effect they have upon the oxygen resources of our streams.

Improved methods of recovery of yeast, spent grains, and possibly dissolved solids ought to be inaugurated by the brewing industry. The recovery of spent grains is practiced by dewatering in expellers and heat drying, but incurs excessive losses to the sewer from the expeller waste. This salvage process should be improved, and more attention paid to the possibility of recovering food materials from the spent yeast.

A war industry that is assuming considerable importance, particularly on the Pacific Coast, is the dehydration of vegetables. Prior to the war, the normal dehydrated vegetable production in the U. S. amounted to about 3,000 tons annually; last year (1942) it was estimated that some 50,000 dry tons would be produced, of which about one-half would be white potatoes. Studies made at a California dehydrator with a capacity of 28 tons per day indicated a loss of 120 lb. suspended solids per ton of potatoes, which contained about 20 percent solids, and 40 lb. B.O.D. per ton. The losses are produced by peeling with abrasive grinders, and by spray washing of the sliced potatoes before drying. Estimating the average receipts of potatoes at 1,000 tons per day in 1942, the losses represent a p.e. of about 250,000 and of 60 tons of solids per day. This is rather insignificant for the country as a whole.

For many years the recovery process or "bottling-up" procedure of the corn products industry has been cited as an outstanding example of salvage from industrial wastes. Some 20 years ago cooperative investigations were started between the S.D.C. and the Corn Products Refining Co., at Argo, looking toward a solution of the problem of disposal of wastes from the Corn Products plant. Some 80,000 bushels of corn are ground per day, and manufactured into starch, glucose, dextrin, corn sugar, gluten meal, feed and miscellaneous products that run into the hundreds. The wastes have been sampled and analyzed practically daily by the S.D.C. since 1920, and losses computed. At first they contained considerable settleable as well as dissolved solids, and the p.e. was around 400,000. In 1923, improved methods of control of settling resulted in prevention of losses of settleable solids, and the p.e. dropped

to 270,000. The material recovered was sold as feed. The soluble solids were still lost, but an investigation finally demonstrated that by re-circulating wash water, partially sterilized, and filtering and washing starch, to remove nitrogenous impurities, the wash water could be concentrated sufficiently to warrant its evaporation to a syrup, which was mixed with the hulls and settled gluten solids and further dried in steam rotary dryers, to produce a readily salable stock food. The bottling-up process was put into effect in 1926, and in 1927 the p.e. averaged around 75,000. The recoveries were quite profitable, and the construction of a waste treatment plant estimated to cost nearly $3,000,000 was made unnecessary.

The disposal of Steffens waste from beet-sugar manufacture has not always been practiced in the past, but new food products, including glutamic acid and betaine, are now being manufactured from Steffens waste at a plant in Ohio.

Yeast wastes are hardly concentrated enough to warrant evaporation, and therefore they must be treated by the least costly method available. The Standard Brands plant at Pekin, Ill., has been operating digestion tanks for the partial treatment of yeast plant wastes, and using the gas for heating and other purposes around the plant.

Malt wastes are very dilute and apparently no attempt is made to re-circulate the wash water as is common in other industries. The problem in malt production is probably more difficult than in other grain industries since the water must not interfere with the sprouting of the barley, and this may prevent the re-use and concentration of the wash water.

Salvage from sulphite pulp process wastes has for many years been the favorite field for research in waste prevention, and hundreds of patents have been granted in this field, but the problem is still unsolved. There are two operating recovery plants frequently mentioned, the Howard Process at the Marathon Paper Mills in Rothschild, Wis., and the experimental Paulson Process, in Pennsylvania, but the former has not been adopted elsewhere in spite of the many products that have been produced at the Marathon plant from sulphite liquor, and the latter has not yet had any full-scale development.

Lately, there has been considerable agitation in the U. S. concerning the use of sulphite liquor for alcohol production. The idea is not new, but previously has been considered unlikely to prove an efficient method of producing alcohol by fermentation, because of the large amount of water in the sulphite liquor, as compared with the much higher solids content of grain mashes or molasses.

In Germany and Sweden alcohol is made from sulphite pulp. Sierp stated in 1939 that Germany produced about 14,000,000 gal. of alcohol per year from fermentation of sulphite liquor. Nine liters of alcohol can be produced from 1,000 liters of sulphite liquor. The steam requirement is high, ranging from 1.25 to 1.50 lb. per gal. of liquor. The ethyl alcohol is contaminated by acetone and methanol and must be purified. About 2 percent of the solids in the sulphite liquor is fermented, and 8 percent of organic matter remains in the still slop. This may be utilized as a nutrient medium for growth of yeast to be used as fodder.

These uses of sulphite liquor have not as yet been developed in the U. S., but are undoubtedly now under investigation, in view of the interest in alcohol for synthetic rubber. With reference to abatement of pollution, however, production of alcohol from sulphite liquor would be relatively ineffective.

Since rubber reclaiming is already a salvage operation, there is not much hope of reclaiming materials of value from the waste waters, which are putrescible and have a high p.e. There are only six or seven reclaiming plants in the U. S., therefore, the pollution is of limited significance.

The writer has not had the opportunity to study wastes from the manufacture of synthetic rubber, but suspects that the polymerization wastes from Buna-S, containing soap, glue, sulphonates and other organic solids, might have a considerable B.O.D. and create a waste disposal problem. Here again the urgency of production might condone a moderate degree of stream pollution, and provide a case for decision by the suggested Water Priorities Board.

The salvage of phenol from ammonia-still wastes produced in byproduct coke plants has assumed importance in the war economy because of the need for phenol in manufacturing picric acid (trinitrophenol), used as an explosive, and also because of the use of phenol in plastics.

Synthetic phenol now supplies much of the market, but it is thought that byproduct phenol may have some advantage in the manufacture of plastics.

Two processes for recovery of phenol are in use—the benzol extraction process and the Koppers vapor recirculation process. There are a number of plants of each type in the U.S., but many byproduct coke plants do not have any type of phenol recovery. Installation of recovery plants is probably out of the question during the war, but many coke plants should be required to recover phenol or dispose of the wastes in some satisfactory manner.

There are four byproduct coke plants within the S.D.C. area and all were included in the industrial waste survey. None of them have phenol recovery plants and the wastes are sewered. At the sewage treatment works of the S.D.C. approximately 92 percent of the phenol is destroyed in the activated sludge process by biological oxidation. The amount of air required is considerable inasmuch as the wastes have a p.e. of approximately 100,000. As yet no charge has been made for this method of disposal.

The disposal of waste pickle liquor from steel mills is one of the largest and toughest problems in the field of waste disposal. Some years ago pickling was used mainly for sheets, tubes and wire, but now it is also used for alloy billets to detect flaws, and there has been a great increase of waste with the development of continuous pickling. On the other hand inhibitors have reduced the amount of iron going into solution and thus have in part counteracted the expansion

Table IV—Salvage From Wastes

Waste or industry	Recovery process	Product recovered
Digested sewage sludge	Air dried	Low grade fertilise
Activated sludge	Filtered and heat dried	Fertilizer
Sewage	Skimming	Grease
Settled sewage sludge	Digestion	Gas for heat and pow.
Organic chemicals	Recirculation, closed system	Organic acids
Organic chemicals	Heat, distillation, precipitation	Sulfur, SO_2, solvents, salts
TNT	Dilution plus storage	Releases vacuum evaporators
Alcohol	Clarification, evaporation	Feed from still slop
Breweries	Dewatering, drying	Feed and food extracts
Vegetable dehydration	Air drying	Feed
Corn products	Recirculation, evaporation	Feed
Beet sugar	Extraction	Food extracts, betaine
Sulphite liquor	Howard 3-stage pptn.	Sulphite, fuel extracts
Sulphite liquor	Fermentation	Alcohol, yeast
Rubber	Alkaline digestion	Reclaimed rubber
Byproducts coke	Extraction or vapor separation	Phenol
Pickle liquor	Sintering — "Chemco"	SO_3, Fe_2O_3
Pickle liquor	Precipitation, drying	Ferron — insulator
Tannery	Extraction	Chrome salts
Packinghouse	Skimming, solids recovery	Grease, tankage

in use of acids for pickling. Sulphuric acid is used predominantly, with lesser amounts of hydrochloric and nitric.

In 1938 a survey was made of pickle wastes at nine plants in the Calumet Area of Chicago and over a period of several weeks the content of iron in the wastes averaged from 3.5 to 6.5 percent, free sulphuric acid from 4.5 to 8.3. When computed to 100 percent operation of all plants, which is now the case, the data show a loss of 3,500 tons of iron and 3,340 tons of sulphuric acid (as H_2SO_4) per year.

All of this is discharged into the Calumet River, whose waters are reddish-brown in consequence. However, this is less objectionable than the difficulties formerly encountered when the wastes were discharged into the sewers tributary to the Calumet Sewage Treatment Works. Iron hydroxide was precipitated in the porous air-diffusion plates at this activated sludge plant, thus interfering seriously with its operation and requiring frequent cleaning of the plates with sulphuric acid. This difficulty has been experienced at many other activated sludge plants in the U.S. and constitutes one good reason why pickle liquor should not be discharged into sewers, the other main one being the corrosion and destruction induced by these highly acid wastes.

Several years ago the American Iron and Steel Institute established a research group at the Mellon Institute, under the leadership of Dr. W. W. Hodge of the University of West Virginia, for the purpose of studying all phases of the problem of salvage or disposal of pickle liquor. The studies are still under way inasmuch as no satisfactory process has yet been found. A new process would be likely to prove satisfactory if it gave promise of profits, or low operating expenses.

An enormous amount of information including all available European experience has been collected by this group. A number of ingenious processes have been worked out in Germany and Belgium, as reported prior to the war, but it is doubtful whether they can operate without subsidies.

In the U. S. considerable publicity has been given to the Ferron Process, which was installed at the Sharon Steel Co. several years ago. The future of this development depends upon the properties and sales value of the insulating or building material, consisting of ferric hydroxide and calcium sulphate plus a filler, and not upon any particularly new or ingenious process for disposal of the pickle liquor. Another large-scale process of interest is that of the Chemical Construction Co. at the Titanium Pigment Corp., Sayreville, N. J., where the dewatered copperas is mixed with iron pyrites and the mixture roasted to produce iron oxide and sulphur dioxide. This process requires a large installation in order to be economically feasible, and appears to be out of the range of most pickle liquor problems.

There are various ways to dispose of pickle liquors, mainly by addition of lime, but it has been the objective of the Institute's group to find more attractive procedures and to avoid the heavy expense of this means of disposal which provides no salvage. It was thought that iron salts might be needed during the war to replace chromium salts in tanning, but this has not been necessary, and in any case is undesirable because of the inferior tanning value of the iron salt. The uses of iron salts in sewage treatment are limited and far from extensive enough to dispose of more than an insignificant amount of pickle liquor.

The Institute's various papers on the investigation give details too numerous to list here. This salvage problem is very active and some progress is bound to result from the intensive study directed toward utilization of pickle liquor. Otherwise, some substitution for pickling will have to be found. An English chemist recently referred to pickling as a barbarous procedure, probably from the viewpoint of the Conservationist.

If chromium should become highly critical and chromium salts expensive, it might be feasible to operate some of the many patented processes for recovery of chromium salts from tannery waste liquors. Otherwise, there does not seem to be much possibility of salvage from tannery wastes.

Grease recovery from packinghouse wastes by flotation

Grease is the valuable material in packinghouse wastes, and the packers recover as much as possible in catch basins. The larger packers maintain technical supervision over this salvage operation, although the catch basins are not always of adequate size or design. Retention of paunch contents and paunch manure within the packinghouse should be mandatory, also evaporation of all blood. Dry rendering should replace the wet process wherever possible.

This discussion has been concerned mainly with the possibility of salvage from industrial wastes, and not with the problem of treatment of wastes after they reach the point of disposal. However, the necessity for treatment is actually more urgent than the need for demonstrating that byproducts can be recovered profitably from wastes. The tremendous expansion in basic industries and the establishment of many new types of chemical industries are resulting in a great increase in volume and type of industrial wastes, to such a degree that our rivers and lakes will not be able to assimilate the polluting solids by processes of self-purification, unless the wastes are treated so that they can be diluted in the minimum flow of the stream without offense to sight, odor, or health. In this discussion industrial authorities have been urged to establish divisions of their organizations charged with the duty of investigating their waste disposal problem in logical steps, with reference to (a) salvaging recoverable products within the plant, (b) determining the relative importance of wastes from the standpoint of pollution, (c) investigating the processes of treatment available for non-recoverable solids, (d) studying river flows, B.O.D., reaeration, oxygen balance, or any other factors that will enable the company to spend its money wisely, and finally (e) presenting data and meeting sanitary authorities on a technical basis with data and proposals that will be convincing and conclusive.

At present the shortage of technical personnel may prevent the establishment of such groups even in large industries, but the time is coming when something must be done to curb industrial waste pollution and the wise manufacturer will be the one who is best informed. In this case a parting slogan might be—in time of war prepare for peace.

Fluid Catalytic Cracking Plant Begins Operations at Bayway

EDITORIAL STAFF REPORT

Chem. & Met. INTERPRETATION

Development of the "fluid" catalyst in cracking is undoubtedly one of the outstanding technological developments in the petroleum field within the last few years. The first unit in the East utilizing this principle, just officially opened by the Standard Oil Co. of N. J. at its Bayway refinery, is now turning out large quantities of high-octane base stock for a superior aviation gasoline.—*Editors.*

During early 1941 the Standard Oil Co. (N. J.) announced a new catalytic cracking process which uses a so-called "fluid" or moving catalyst instead of the "fixed bed" or lump type used in other catalytic cracking processes. The first plant in the East to use this principle has been operating at Bayway for some months and was officially dedicated January 15 of this year. In the "fluid" process the catalyst, which is really a solid so finely divided that it can be handled like a fluid, is suspended and flows along in intimate admixture with the oil stream passing through the cracking chamber.

The important operating advantage of the fluid catalytic process is its complete freedom from mechanical means for moving the catalyst or changing the flow of the cracking or regenerating stream. The only mechanical equipment are the pumps which initially deliver the oil to the vaporizing furnaces and a blower which delivers air to the catalyst regenerator. The catalyst is circulated in a manner analogous to an air lift, using petroleum vapor being cracked or the air used for regeneration or removal of coke from the catalyst.

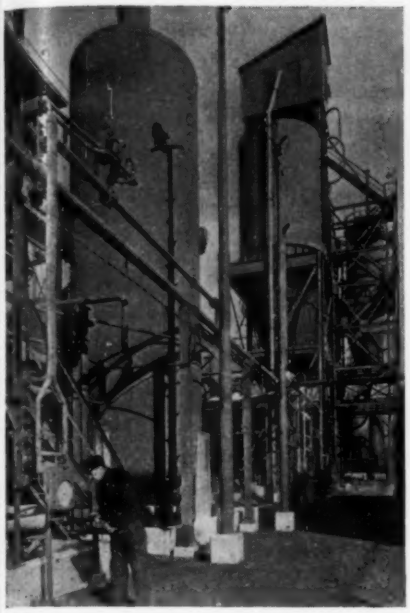
This structure, which is 235 ft. high, is the recently completed fluid catalytic cracking unit of the Standard Oil Co. (N.J.) at its Bayway refinery. Some 33 such units will be built throughout the nation

Disadvantages of "fixed bed" catalytic processes include losses due to the cyclic type of operation and the necessity of controlling the flow of hot gases and of removing as much as possible of the heat from such gases in order to improve the economy of the process. The "fluid" catalyst eliminates the requirement of forming the catalyst into lumps which can withstand without deterioration the alternating temperatures of the fixed bed type of operation as well as the abrasion of high velocity gases. Several types of catalysts are thus made available to this new process which otherwise would be impractical. This, in turn, permits much greater control over the products produced in the cracking operation.

This type of cracking plant can produce large quantities of raw materials required for making 100-octane aviation gasoline, toluene for T.N.T., and synthetic rubber. It can produce a wide variety of petroleum products, such as aviation base stock, motor gasoline, heating oil and mixtures of ethylene, propylene, butylenes, isobutylene, isobutane and isopentane. The first two of these gases are raw materials for alcohols, and the butylene may be combined with isobutane to make blending agents for 100-octane gasoline or further processed into butadiene for synthetic rubber.

This method of refining was developed after years of research and experiment by the technologists and chemical engineers of the Standard Oil Co. of New Jersey. The Bayway unit, strategically located both for war and peace-time uses, is the first to be built in the vital eastern seaboard region. Two other fluid catalytic cracking plants are now in operation; one in Louisiana and one in Texas. Some 33 of the units are scheduled for operation in this country, and when these are in full production this process will have the largest cracking capacity of any process in the country.

The new unit, being 235 ft. high at its highest point, would tower over



Above—Taking a temperature reading at the new cracking unit

the tallest building in a fair sized city. The design resulted in some 950 blueprints and erection of the unit required 850,000 man-hours of labor. The entire operation is controlled from a central room, where 175 meters, gages and instruments of all kinds permit rigid control of all operations. Fewer than nine men are required for operation and these operators are present more for reasons of safety than out of actual operating necessity.

OPERATING PRINCIPLES

Raw material for the fluid catalytic cracking plant is gas oil with an A.P.I. gravity range of about 27-35 deg. The catalyst, delivered to the plant in box cars and unloaded by air hose, is fed into a pipe through which hot vaporized gas oil is pumped under about 10 lb. pressure toward a reaction or cracking chamber. This is a steel vessel 15 ft. in diameter and 28 ft. high. Near the hopper-like bottom is a perforated plate through which the gas oil and catalyst mixture is forced. This gives an even distribution of vapor throughout the reaction chamber. The temperature of the mass is around 800-975 deg. F. Pressure at the top of the cracking reactor is about 10 lb. per sq. in. gage and at the bottom about 15 lb. per sq. in. gage.

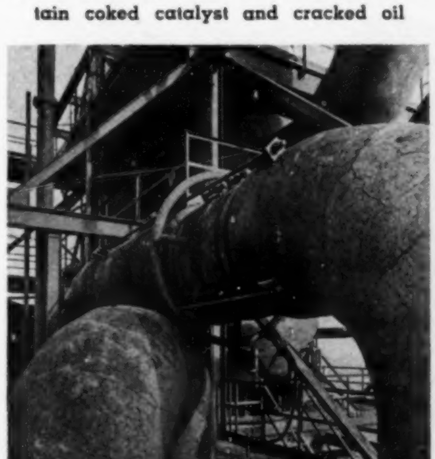
Recovery of the catalyst is accomplished by passing the entire mixture from the reaction unit through a series of cyclone separators. From these the catalyst particles are forced down through a pipe into a spent catalyst chamber. From this they flow into the regeneration chamber in which the carbon is burned off the particles at 1000-1150 deg. F. in the presence of a stream of air. The catalyst leaves mixed with some gases. To get rid of these, three more cyclone separators and a Cottrell precipitator are provided. The cyclones and Cottrell have outlets for clean catalyst, which falls into a chamber from which it feeds to a perforated pipe. The pipe is always full of catalyst particles.

Catalyst losses are probably not over one or two tons per day or a very small fraction of one percent of the total. The catalyst cycle averages about 20 minutes, and total catalyst circulation amounts to several hundred tons per hour. The charging capacity of the unit is several thousand barrels of stock per day. A 100-barrel charge will ultimately give, together with other blending agents, about 85 bbl. of high-grade aviation gasoline.

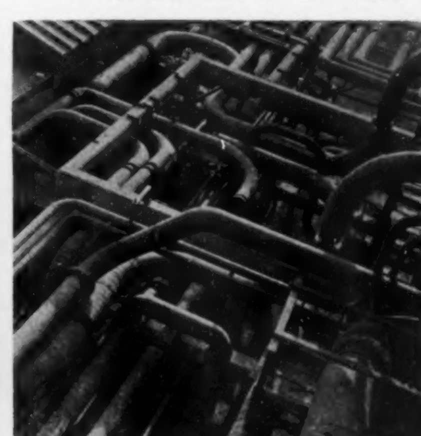
Right—Into these huge hoppers is fed the "fluid" catalyst used in the cracking step

In this central control room, less than nine men manipulate 175 instruments to control the operation of the entire fluid catalytic cracking unit

These huge pipes, six ft. in diameter, contain coked catalyst and cracked oil



This maze of pipes contains heated gas oil or reduced crude for the cracker



Transporting and Storing Liquefied Petroleum Gases

PAUL M. RAIGORODSKY, ***Assistant Director, Natural Gas and Natural Gasoline Division, Petroleum Administration for War***

***Chem. & Met.* INTERPRETATION**

Competition will increase for tank cars for handling liquefied petroleum gases, isobutane, butadiene, isobutylene, etc., for synthetic rubber, aviation fuel, and other war materials. Ways and means for overcoming a shortage are discussed by the author.—*Editors.*

LIQUEFIED PETROLEUM GASES are produced at natural gasoline plants, cycling plants, and oil refineries. These gases in general are composed of butanes and propane while fractions produced in refineries may contain appreciable percentages of butenes and propylene. In natural gasoline operations, in addition to a select grade of natural gasoline, isopentane, butane, isobutane, and propane may be produced with dry gas as a byproduct.

Estimates indicate that there are potentially available daily over 400,000 bbl. of butane at refineries and natural gasoline plants. With a modest expenditure of new critical material it may be safe to state that today a much greater volume of liquefied petroleum gas can be made available as a raw material for the industry, and the synthetic rubber and aviation fuel programs.

The use of liquefied petroleum gas as a fuel for internal combustion engines calls for special attention. Ethane, propane, and butane are the raw materials essential in the manufacture of modern aviation fuels. Ethane and propane may be cracked to ethylene, propylene, benzene, and toluene, and normal butane isomerized to isobutane. These raw materials may be processed by modern methods of dehydrogenation, polymerization, alkylation, and hydrogenation into the desired type of aviation fuel.

Normal butane is now being employed as a raw material to produce butadiene; ethane and propane to manufacture styrene (these materials yielding Buna S rubber). Isobutane on dehydrogenation yields isobutylene, the major constituent of butyl rubber.

The unique physical properties dictate the use of containers which differ from the conventional one now employed for liquids with low vapor pressure. The increased demand for liquefied petroleum gas has been accompanied by a demand for special containers for their transportation. This demand is amplified in that similar cars are required for the transportation of chemical raw materials such as isobutane, butadiene, and isobutylene. These materials are gases at the normally prevailing temperature and at atmospheric pressure. If they are to be stored and transported at normal temperatures, they must, therefore, be stored in containers capable of withstanding considerable internal pressure. They may also be stored in insulated containers at low temperatures at little or no internal pressure.

Recent developments have allowed for increase in size of containers employed in marine shipments.

The shipment of liquefied petroleum gas by rail in special pressure tank cars, with capacities from 8,000 to 12,000 gal., is now regular practice and governed by Interstate Commerce Commission regulations. It is this method of transportation which is of the greatest importance to the industry. It presents one of the outstanding problems at the present time, because of the connection with the synthetic rubber and aviation fuel programs.

The number of tank cars available for the transportation of liquefied petroleum gas, butadiene, and butylenes as of Aug. 1, 1942, was as follows:

Liquefied petroleum cars (104A) 1,594.

Cars being built (Rubber Reserve Co.) 250.

New cars (Delivery started 1-1-43) 100.

Proposed conversion from 104 to 104A 150.

Total 2,094.

In addition to the number of cars, the time required for a complete round trip is of importance. The problem of efficient tank car usage is not one of static nature. The railroad systems of the United States are of intricate design and with source and points of consignment changing from day to day this problem becomes extremely complex. Therefore, a perfect pattern of tank car movements today may be only 50 percent efficient tomorrow. Nevertheless, this most complex problem is now being satisfactorily and efficiently solved.

In order that the industry may cooperate to insure complete accord in the war effort, certain facts of importance must be observed and followed immediately by definite action. These facts, together with recommendations, are as follows:

1. The number of pressure tank cars available to the liquefied petroleum gas industry as such will decrease throughout 1943. This condition will develop for synthetic rubber and aviation gasoline plants are rapidly nearing completion and additional tank cars will be required to transport products such as butadiene, isobutane, butenes and other similar chemical raw materials needed in the war programs. The special type tank cars will be withdrawn from normal operations during 1943 with but little notice. Therefore, steps must be taken at once to insure the satisfactory operation of this industry under these conditions. To offset the reduction in tank car use, the industry must plan and perfect methods whereby they may be emptied and made available for the return trip in a minimum of time. Transportation experts in the Office of Petroleum Administration have stated that liquefied petroleum gas deliveries may be increased 50 percent with 100 percent efficiency in turn-about time.

2. The expansion of the industry along normal lines will be impossible until the end of the war. New installations will be restricted.

3. Industry must dovetail operations to insure the maximum use and effectiveness of all existing storage and transportation equipment. With changing conditions dictated by revised methods of tank car use, the present equipment should be pooled and movements coordinated to allow for the handling of a maximum of liquefied petroleum gas with a minimum of time, labor, and critical material. The problems facing the industry during the coming year can only be solved by complete cooperation among all companies.

4. Storage facilities must be expanded and so arranged that products may be quickly and safely stored in order to eliminate any delay whatsoever in the return of tank cars to active service.

Based on a paper entitled the Liquefied Petroleum Gas Industry and Its Relation to the Aviation and Synthetic Rubber Programs presented before the Compressed Gas Manufacturers Association, New York, Jan. 26, 1943.

Selecting Construction Materials For Centrifugal Acid Pumps

W. E. PRATT *Worthington Pump & Machinery Corp., Harrison, N. J.*

***Chem. & Met.* INTERPRETATION**

Last month we presented the first of a group of articles written by Mr. Pratt to deal with the general theme of selection and operation of centrifugal acid pumps under war-time conditions. The present article consists of related excerpts from a paper by the author which was awarded a prize in a recent competition sponsored by The Hydraulic Institute. The entire prize paper is not published here because later articles in the series will treat the omitted subjects in considerably greater detail. The third article of the group will discuss a centrifugal pumping system involving a long suction line, with data on pump performance; and the fourth, some new phases of the solution of packing and stuffing box troubles.—*Editors.*

The acid pumps required in many types of war production plants may represent a very small fraction of the total quantity of equipment required, but they represent essential equipment required for a major part of the actual operation. If they fail from corrosion or wear, serious interruption to production follows unless spares are available and/or their substitution can be made quickly.

One of the general problems applicable to all types of chemical pumps is the selection of a material which is suitable for withstanding corrosion and wear produced by the liquid or slurry to be handled, keeping in mind possible changes in process. The pump should use a material that contains the minimum amount of critical elements compatible with the above requirement, but a material or alloy that is standard with many pump manufacturers. It is desirable to avoid materials whenever possible that present a breakage hazard or that cannot be readily repaired in the field in an emergency.

There are so many really excellent materials and alloys available today for building chemical pumps that the problem of selecting one or more that will stand up under any given condition has been greatly simplified. In fact, there are so many now available that the chief problem for the engineer who must write specifications for acid pumps is to be familiar enough with the materials that are available to be able to make the best selection.

Materials available include: (1) Stainless alloys of a wide variety in chrome-nickel and nickel-chrome, with smaller amounts of other elements; (2) nickel, and nickel-copper alloys; (3) copper-silicon alloys; (4) alloy cast irons; (5) high-silicon iron; (6) rubber and rubber compositions; (7) carbon; (8) plastics; and (9) ceramics, including glass, stoneware and porcelain.

If complete information is not available to the specification writer on the suitability of these various materials for a specific condition, and the condition is one that has not been fully explored in his own organization, data can usually be furnished very promptly by pump manufacturers using these alloys.

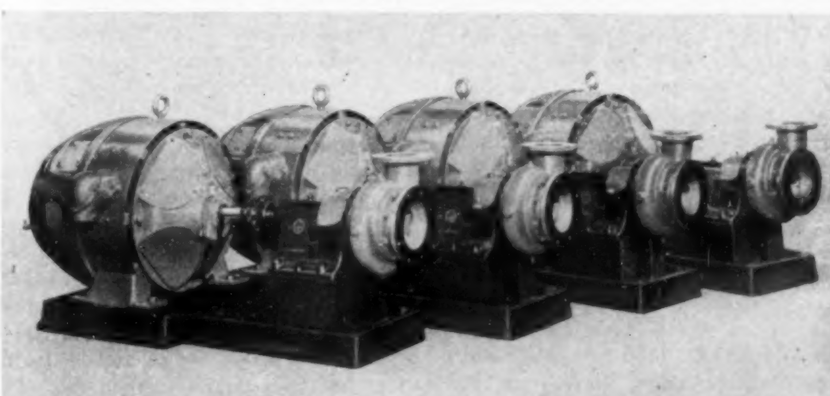
When there is a possibility that there may be a change in process, it is sometimes possible to choose a material that will be suitable for all of the alternate conditions. In development of the synthetic rubber industry there were many possible processes involving widely different solutions, but pumps were available that would be suitable for all solutions that were being contemplated.

The change from brass cartridge cases to steel cartridge cases is another instance where selection of materials proved to be of major importance. Machines used for pickling the cartridge cases could be made of 18-8 molybdenum stainless steel as long as brass was being pickled. However, when steel cartridge cases are pickled the pickling solution no longer contains copper sulphate which acts as an inhibitor on 18-8 stainless alloys and permits their use. The high nickel-chrome-molybdenum stainless alloys are highly resistant to the acid pickle solution in either case, whether copper sulphate or ferrous sulphate is the main metallic salt in solution. It was fortunate that the latter alloy was used in pumps circulating this pickle acid as no change in pumping equipment was necessary. This cannot be said of many parts of the machines.

It is obvious that a conscientious specification writer should cooperate with WPB and use the least possible amount of critical materials. However, a thorough knowledge of pump manufacturers' standards must frequently alter a selection of materials for chemical pumps, based on this objective.

Thus a certain process may be han-

These Worthite pumps, viewed before installation in an eastern plant, have since been pumping sulphuric acid-copper sulphate electrolyte for three years



dled satisfactorily by an alloy iron containing 25 percent of critical elements. But, if no pump manufacturer is making acid pumps regularly of this alloy iron, then it means slow deliveries and an impossible situation, should occasion arise for quick emergency repair parts. Hence, if this same pump manufacturer had standardized on an alloy containing 50 percent of the critical elements, and carried pumps and parts in stock made of this alloy, it would be only good common sense to use the material containing the higher percentage of critical elements, even though the more corrosion resistant properties were not required.

Breakable materials, such as ceramics, hard rubber and high-silicon iron, have their field where they are the most economical material to use. Where there is available a suitable non-breakable alloy steel that will do a satisfactory job, this is the material that is usually preferred. It is quite possible that a pump of a ceramic material might stand up for years and outlast a pump of an alloy steel, but the alloy steel pump can be repaired in the field in case of emergency by welding and machining. Usually a broken part in a low-strength, brittle material is beyond repair and a new part must be secured from the manufacturer. Unless the spare part is in stock, many weeks of annoying and perhaps serious delay can be caused.

OPERATION AT SHUT-OFF

One condition having an important bearing on the corrosion of an acid pump is the possibility of operation at shut-off (or with no flow). This condition is bad enough on a water pump but it may be infinitely worse on an acid pump. An ordinary centrifugal pump operating at 1,750-r.p.m. with water in the pump and no flow passing through the pump, will cause the water to increase in temperature to the boiling point in 12 to 15 minutes. Since most acids increase in their corrosive properties toward metals with increase in temperature, it is easy to see what may happen to an acid pump when so operated. Acid pumps made of a high nickel-chrome-molybdenum alloy, that has a very small rate of corrosion (0.0005 in. depth of corrosion per year) in weak sulphuric acid at 180 deg. F., have been known to fail completely in less than a year in handling this acid when allowed to operate only occasionally either at shut-off or with the supply tank empty. The same thing has been observed with alum solutions which have even less corrosive effect on such alloys.

Very few data are available on the exact rate of corrosion under such conditions as, of course, operation in such a manner is usually a case of negligence and the full facts are seldom divulged. Similar conditions, involving high temperatures, perhaps *above* the boiling point, and violent agitation under pressure, cannot be reproduced for study under laboratory conditions. It must be admitted from evidence and from all good operating practice that the condition should be avoided. Hence, if there is any chance of such an operating condition occurring, the installation should provide such features as to make it impossible, as is done on boiler feed pumps. Automatic devices can be used to shut the unit down when a dangerous condition approaches, or a very small by-pass line may be used effectively.

Where an acid pump, of some breakable materials, is run at shut-off for a short time, say due to an intermittent supply, there is very great danger of breakage of the pump when the supply is reinstated with much lower temperature liquid. Sudden thermal shocks from a high temperature to a low temperature invariably break high-silicon iron and ceramic materials.

ELECTROLYSIS

Outside of a few electrochemical industries the phenomenon of electrolytic corrosion occurs so infrequently that it is most usually ignored as a possible cause of failure of acid pumps made of certain metals.

In most electrochemical operations and even in electroplating work, the possibility of stray electric currents causing trouble, due to electrolysis, is so well recognized that installations of acid pumps usually take this into consideration. Lead and high-silicon iron are relatively little affected by the low current density usually encountered in pump installations in such plants, but the acid resisting alloy steels are seriously affected by low current densities. It is these alloy steels that are now being used mostly in acid pumps and such pumps must, therefore, be protected from the possible serious consequences of electrolysis.

In simple electroplating work where the acid pump is most frequently employed for circulation, filtering and transfer work, the usual hook-up employs rubber acid hose and hence almost all of the possible danger is eliminated. When the pump is on a portable truck which has rubber-tired wheels, this makes the insulation from stray electric currents complete.

Where large pumps are employed for circulating electrolyte in electrolytic tank houses, special precautions must be taken. The suction and discharge lines should be interrupted with non-conducting sections of pipe or hose. The motor conduit and the water seal line to the stuffing box must be similarly interrupted, and the drain line from the stuffing box must be hose or non-conducting material. The concrete foundation must be kept bone dry. If not, there may be a connection to the ground by means of a drip which will cause a wet, conducting spot from pump base to floor. Otherwise rather elaborate insulating devices must be used to avoid a "ground" from the pump through its base.

Occasionally electrolysis has caused failure of acid pumps where no one would have suspected its presence. In a paper mill where frequent failures of a pump occurred in handling weak acid, it was finally discovered that stray electric currents were coming into the plant through a large cast iron line. The condition was recognized when this line corroded through at the point where it contacted a metal tank where moisture was usually present from condensation.

In a textile mill the pump handling weak sulphuric acid from a lead lined mixing tank failed regularly every three or four months. Samples of the same metal of which the pump was made were tested out in the tank, under conditions which would cause galvanic action, without showing any measurable loss. Attempts were made to insulate the pump after stray electric currents were detected by instruments. When several attempts to insulate the pump failed, due to some overlooked contact, a high-silicon iron pump replaced the alloy steel pump and the trouble stopped.

It has been contended that, by bonding the pipe joints and jumping a connection across the pump and grounding the pipe line, troubles from electrolysis can be avoided. While this is helpful as it may shunt the circuit, it is not a sure cure of all trouble. The internal surfaces of the pipe usually become coated with corrosion products and present a resistance to the flow of the electric current. On the other hand, the internal surfaces of the pump are continually cleaned by the violent agitation and an electric current always seeks the path that presents the least electrical resistance. Unfortunately that is frequently the pump surfaces. When the pump is the anode in the circuit metal-electrolyte-metal then serious loss of metal occurs in accordance with Coulomb's Law.

PLANT NOTEBOOK

RENEWING HEAT TRANSFER PROPERTIES OF FOULED AND INACCESSIBLE HEATING SURFACES

JOHN H. DITTMAR *Pennsylvania Sugar Co., Philadelphia, Pa.*

PROCESSES utilizing steam are confronted quite frequently with the problem of inefficient heat transfer, due to fouling of heating surfaces by oil and other organic contaminants in the steam. This mixed oil and carbonaceous material is periodically burned out of steam coils by heating the outside of the coils with a blow torch. However, in the case of steam chests this is impossible, because of the inaccessibility of the surfaces of the closely packed tubes inside the chest. The result is loss of time and production. Previous attempts to remove this deposit by chemical means proved unsuccessful. Organic solvents such as kerosene, gasoline, carbon tetrachloride, etc., would soften the film, but not remove it without brushing.

The deposit is a mixture of organic decomposition products and carbon from oil broken down by the high steam temperatures, and baked on the heating surfaces. In the past when tubes in inaccessible chests became so fouled as to interfere seriously with heat transfer, the common procedure was to remove the tubes and insert new ones. This is time consuming and costly. In the past few years, however, a chemical treatment has been developed at Pennsylvania Sugar Co., which permits the cleaning of the fouled surfaces without removing the tubes from the chest. The present labor situation, priorities on critical materials, and time lost by inefficient heat transfer, make the procedure which will be discussed in the following particularly timely.

The procedure is a two-step process, first using an oxidizing agent and then following with a reducing mixture which removes the products of oxidation. A description of an application on a 70 ton massecuite capacity calandria vacuum pan at Pennsylvania Sugar Co. is as follows.

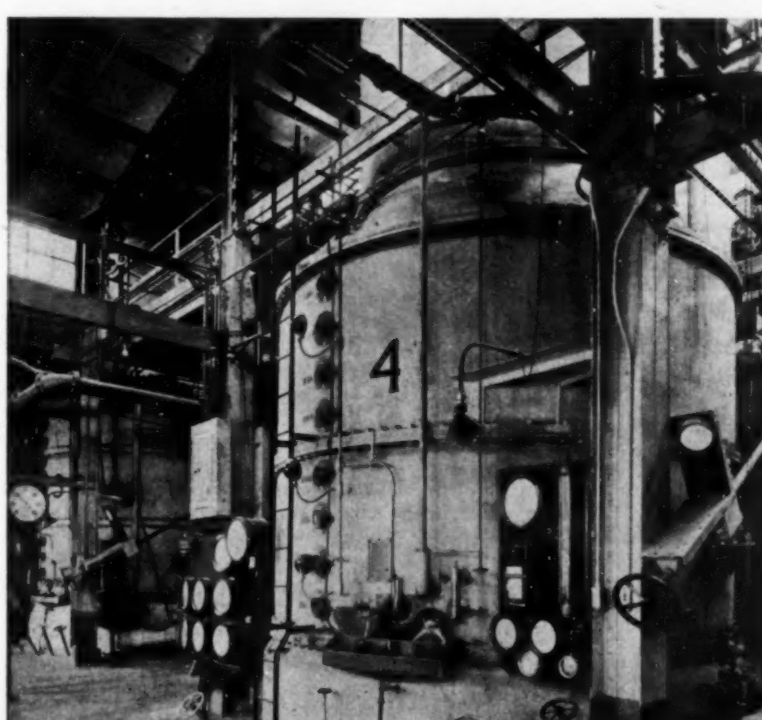
Our large calandria vacuum pans have cast iron bodies and 14-gage copper steam chests. The volume of the steam chest is 2,000 gal. and it contains 3,600 sq. ft. of tubular heating surface. The cleaning of the steam chests is usually carried out during week-ends. A tank with a bottom outlet is mounted on a platform and connected to the steam chest. A mixture of $1\frac{1}{2}$ percent potassium permanganate and 2 percent caustic soda is run into the chest by gravity until it is filled. This is best gaged by a sight glass attached to the pan. The steam chest gas trap vent is open to the atmosphere. When the chest is filled, steam is turned into the body of the pan, and the solution in the chest is kept at near 212 deg. overnight. In the morning the nearly exhausted solution is run to the sewer, and a sample taken at this time should show a slight excess of permanganate over that required to completely oxidize all oxidizable organic matter. This is shown by at least a pale pinkness remaining in the solution.

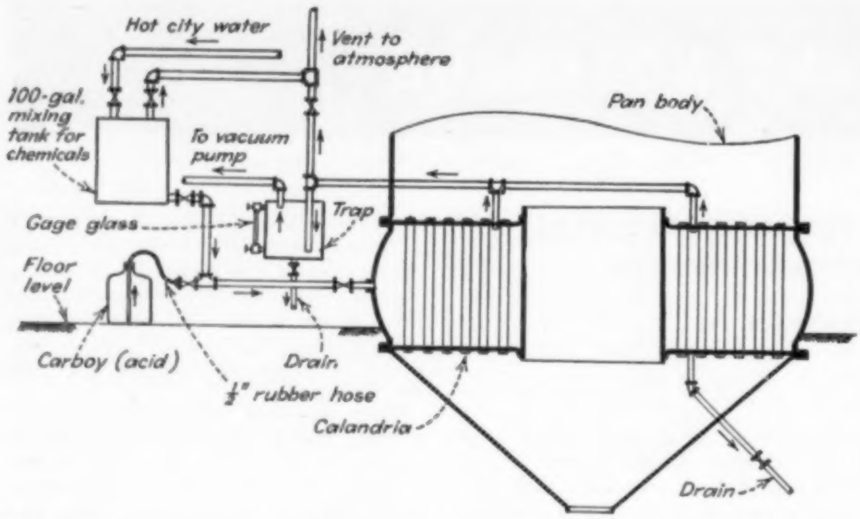
The chest is now given a rinse with hot water, followed by a mixture of a 1 percent ferrous sulphate solution in 3-5 percent hydrochloric acid which is heated to 212 deg. F. for $\frac{1}{2}$ to 1 hour. This solution is run to the sewer and the chest is then freed of the acid by washing with hot water or by steaming out. The vacuum pan is now ready for use with a completely renovated heating surface in the steam chest. When soda ash is used along with or instead of caustic soda in the first step, then the rinsing of the chest before adding the acid solution may be dispensed with. The carbon dioxide liberated when the acid reacts with the Na_2CO_3 remaining in the film helps dislodge the film from the surface.

This procedure was used on eight vacuum pans at the Pennsylvania Sugar Co. and a successful cleaning obtained in every case, as measured by savings in boiling time of sugar strikes. The vacuum pans were of various sizes and the tubes with various degrees of oil and carbonized deposits. Some pans were heated by 150-lb. steam and others by exhaust steam. From the experience gained up to the present time, the following generalizations can be drawn.

The time saved on boiling a strike of sugar comprising 140,000 lb. of massecuite ranged from 15 percent for fine granulated sugar, to 20 percent for standard granulated sugar strikes. Crystallizer massecuites which formerly took 14 hours to boil were boiled in 11 hours after cleaning of the tubes. Inspection of the tubes after cleaning showed a bright new condition of the

An 80 ton massecuite vacuum pan in the plant of Pennsylvania Sugar Co., in which the time to boil a sugar strike was reduced 15-20 percent by cleaning the steam chest tubes as described in the text





Diagrammatic arrangement of equipment and piping for the chemical cleaning of the calandria of a sugar pan

copper surface, which before had contained a 1/16 to ⅛-in. coating of baked organic matter mixed with grease and oil. In some cases the tubes were slightly spotty with remaining dirt, the cleaning being estimated to have been from 90 to 95 percent complete. In these cases a second cleaning was not given, although a mild repetition of the process would have finished the surface renewal. In no case was there damage to the body or steam chest due to the use of the chemicals. There is a negligible loss of copper from the short acid treatment.

The chemical reactions involved are as follows:

$$2\ KMnO_4 + 2\ NaOH = 2\ KNaMnO_4 + H_2O + \tfrac{1}{2}\ O_2$$

$$KNaMnO_4 + H_2O = MnO_2 + NaOH + KOH + \tfrac{1}{2}\ O_2$$

In this first step the alkaline permanganate oxidizes the organic matter mixed with the oil and grease and dissolves it, leaving a deposit of manganese dioxide in its place.

In the second step the Ford-Williamson reaction is used to reduce the manganese dioxide, thereby cleaning the surface. The reaction is:

$$MnO_2 + 2\ FeSO_4 + 2\ H_2SO_4 = MnSO_4 + Fe_2\ (SO_4)_3 + 2\ H_2O$$

HCl or H_2SO_4 are used interchangeably in the reaction. It is important that enough ferrous ion be present to completely reduce the MnO_2. In actual use excess of all chemicals is used, because the excess chemicals are less costly than the time and labor of repeating the treatment. The solution strengths mentioned as being used above were found to provide sufficient excess. Naturally almost any reducing agent or mineral acid will serve equally well, but $FeSO_4.6H_2O$ in the form of common pickling residue from steel mills is the most economical. Although HCl alone will theoretically dissolve MnO_2 according to the reaction:

$$MnO_2 + 4HCl = 2H_2O + MnCl_2 + Cl_2$$

this reaction did not occur in the above case unless a very concentrated acid solution was used, which was ruinous to the apparatus being treated.

What Treatment Costs

The cost of chemicals for the standard procedure used at present for cleaning 3,600 sq. ft. of heating surface is approximately $40, i. e., about 1 cent per square foot of surface treated. By substituting sulphuric acid for muriatic acid, the cost of chemicals can be reduced correspondingly.

Although this is the method being used at present by the Pennsylvania Sugar Co., a mixture composed of an organic acid-peroxide or acid chlorate is being experimented with, and it is expected to clean the surfaces with a single solution.

This method can be widely adapted to suit many other difficult cleaning tasks involving organic or mixed organic deposits. In the case of very heavy deposits, it may be more advantageous to use a series of lighter treatments than to attempt complete removal with a strong single dose. In using this method on other types of apparatus with inaccessible surfaces, there are three conditions necessary. (1) The body of the apparatus must be accessible to the solutions. This does not have to be by gravity. On two vacuum pans where the height from the floor and the design of the steam chest did not make gravity filling easy, the solutions were drawn into the chest by applying vacuum to the gas vents at the top of the steam chests. Fullness of the chest was then determined by a small safety tank in the vacuum line between the vacuum pan and the vacuum pump. This tank was fitted with a sight glass. (2) When the material is in the apparatus, heat is required and must be maintained. (3) After the proper reaction time, a means of disposal of the waste liquids is required.

Acknowledgment is given to E. C. Kent, who worked with the author in 1938 on initial experiments. Appreciation is given to Frank Harvey, superintendent and Charles Nellett, assistant superintendent for their kind cooperation.

Data on Various Evaporator Cleaning Tasks Performed at Pennsylvania Sugar Co.

Type of Evaporator	Volume of Steam Space, Gal.	Heating Surface, Area, Sq. Ft.	Hours to Boil Strike: Before Cleaning	Hours to Boil Strike: After Cleaning	Time Saved per Strike, Hours	Material Boiled	Cost of Treatment Chemicals, Dollars	Cost per Sq. Ft. Dollars
Calandria, Vacuum Pan No. 2	2,600	3,888	1.42	1.17	0.25	Fine gran. massecuite	43	0.011
Calandria, Vacuum Pan. No. 4	2,000	3,600	4.0	3.25	0.75	Stnd. gran. massecuite	40	0.0111
Floating calandria, two sections, Vacuum Pan No. 5	Top section, 500 Bot. section, 700 Total, 1,200	1,540	14.0	11.0	3.0	Crystallizer massecuite	38	0.0246
Calandria, Vacuum Pan No. 9	1,000	1,754	12.0	9.5	2.5	Soft sugar massecuite	20.40	0.0116

Safety Measure For Wire Rope

A CONSTANT SOURCE of danger to those handling wire ropes results when clip fastenings or other means of attachment are used, which expose the end of the rope. The sharp wires at the rope end easily produce lacerations or puncture wounds which may be especially dangerous since they are likely to be deep seated, yet may be neglected by the wounded man if they appear superficial and not worth immediate attention.

It has been pointed out by F. L. Spangler, a member of the American Society of Safety Engineers, that a simple method of eliminating the hazard is to braze the ends of the rope with a bronze welding rod, running the bronze back for a distance of an inch or two at the end. When properly done the bronze covers the wire ends, and it also has the advantage of holding the rope end intact so that the seizings can be removed.

If the rope is not preformed it is recommended that two or three seizings be applied, one near the end and the others 4 to 6 in. apart. Preformed rope, from which unbalanced stresses have been removed, does not require the use of seizings.

Bronze welding the ends of wire rope prevents danger of lacerations in handling the rope

PROCESS EQUIPMENT NEWS

Fiber Conduit

OWING to the metal shortage, increased interest is evident in the possibilities of fiber conduit, according to the Brown Co., 500 Fifth Ave., New York, N. Y., manufacturers of a material of this type known as Bermico. In this product wood cellulose fibers are built up and heat-treated to form a rugged tube of homogeneous wall structure which is impregnated to produce a chemically inert, light-weight pipe of high merchanical strength and water resistance. Formerly used largely for the underground installation of electrical cables, the material is now being used in place of metal conduits, as a protective jacket to prolong the life of metal pipe exposed to corrosive liquids or gases, and for other purposes. Such pipes are being investigated for use as soil pipe, for drainage lines and for shallow oil well casings. Other specialized applications as a war-time alternate are at present under investigation.

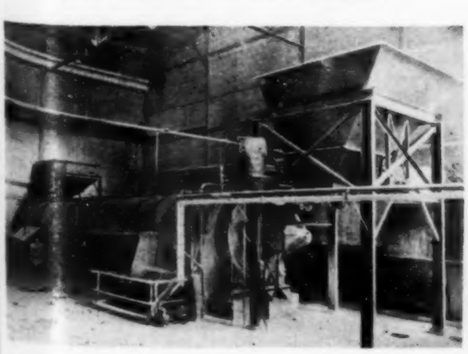
Electron Microscope

USE OF A NEW TYPE of electron optical system which maintains a "fixed" magnification regardless of voltage variation is said to permit the new electron microscope developed by General Electric Co., Schenectady, N. Y., to be used in the accurate measurement of particles as small as one millionth of an inch. According to the manufacturer, previous electron microscopes have suffered in performance because their magnification varied with the applied voltage. The new instrument is capable of enlarging a specimen 10,000 times, and further enlargement of the picture can be made photographically up to 100,000 times the size of the original specimen, or better.

The microscope is mobile, small, and operates on ordinary house currents. Focussing is accomplished electrostatically, rather than electromagnetically as in earlier electron microscopes. The instrument passes a beam of electrons through the specimen inside a vacuum chamber, producing a visible picture on a fluorescent viewing screen which can then be photographed outside the tube. The microscope has been designed for convenience of the operator, with the eye piece at eye level and all controls at the operator's finger tips.

New electron microscope

New dryer for fine mesh materials



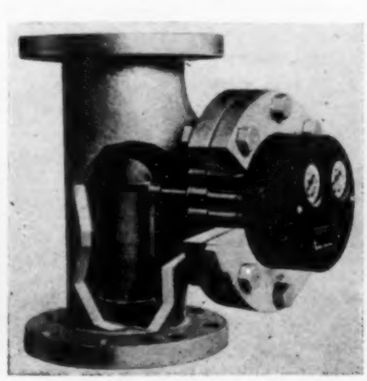
Dryer for Fine Material

TO ELIMINATE the need for independent dust collectors ordinarily necessary in the drying of fine-mesh materials, L. R. Christie Co., 17 East 42d St., New York, N. Y., has introduced a new indirect rotary dryer in which the furnace gases do not come in direct contact with the material being dried. The dryer consists of a metal drum divided into compartments, in order to give increased heating surface, which is inclosed in an insulated steel casing, so as to utilize the entire surface of the outer shell for additional heating surface. The dryer may also be used as a rotary retort, permitting the recovery of gases which are distilled off, or drying may be done in an inert atmosphere.

The design is said to eliminate infiltration of air, but to permit continuous charging and discharging. Among the features claimed for the new dryer are anti-friction bearings throughout, which are totally inclosed and self-aligning; ability to use any type of fuel or heating mediums with an efficiency better than 60 percent; and recirculation of furnace gases to give easy control of temperature and improved efficiency.

Sections of fiber conduit

Rubber-covered level controller installed in a tee



Rubber-Covered Level Controller

FOR HANDLING corrosive liquids, Moore Products Co., H and Lycoming Sts., Philadelphia, Pa., has developed a new liquid level controller which can be completely covered with rubber or neoprene. The control mechanism is designed for installation in a standard rubber-covered tee fitting, or for direct mounting in a tank. A rubber-covered steel flexible shaft eliminates packing glands and bearings, and also provides a simple friction-free method of transmitting the float motion to an air pilot valve or micro-switch, as required.

The flexible shaft consists of a formed tube similar to a bourdon tube, containing a flat lever connecting directly with the air pilot valve or switch. Operation is unaffected by wide variations of temperature or pressure. The instrument operates on the principle of force change due to buoyancy, rather than a float riding on a moving level. The sensitivity is such that a buoyancy change of less than 8 oz. will result in full travel of the diaphragm-operated control valve, permitting the use of a small 4-in. diameter ball float and a short float arm approximately 5 in. in length. By the use of a larger float and long float arm, the device can be used for interface level control of liquids having a specific gravity difference as small as 0.050. Where wider level changes are desirable, elliptical steel floats having ⅛ in. rubber covering can be used. For high- and low-level cut-off, a micro-switch can be used instead of an air-pilot valve. To keep the flexible shaft well within its elastic limit, rubber-covered stops are provided.

Pump Tank Extinguisher

TWO SIZES, 5 gal. and 2½ gal., are available in a new design of pump tank fire extinguisher recently announced by American-LaFrance-Foamite Corp., Elmira, N. Y., for use in controlling magnesium type incendiary bombs. The new extinguisher is built in conformance with emergency requirements of the Government regarding use of critical materials. The pump produces a straight

stream, not a spray, and is supplied with an over-sized air chamber to minimize pulsation, and produce a constant stream with a range of 30-40 ft. The unit is self-contained and can easily be transported up ladders and to points difficult of access. Steel with a corrosion-resisting coating is the material used for the tank.

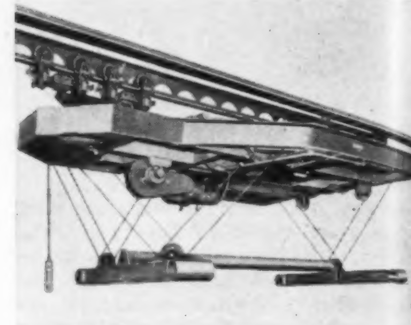
Compact Vertical Pump

A NEW LINE of vertical, single-suction centrifugal pumps for clear liquid service, in capacities from 10 to 500 g.p.m., has been announced under the designation Type SCV by Economy Pumps, Inc., Hamilton, Ohio. Depending on speed and capacity, these pumps are suitable for total heads up to 225 ft. The design is simple, incorporating a single casting comprising the volute and the suction and discharge passages, together with the base. A combination pump cover and motor stand carrying a combined thrust and radial bearing is bolted to the top of the volute. The shaft carrying the impeller, which is equipped with bronze wearing rings, is journaled in a sleeve bearing below the impeller and carried on the ball thrust and radial bearing above. A simple flexible coupling is provided for the shaft.

Among advantages claimed for the new pump is the use of a lower bearing which eliminates shaft whip and assures perfect rotor alignment. The pump requires very little space and carries its motor high and out of the way of dirt and water damage. Should the motor have to be replaced, a simple machining operation makes it possible to replace the original motor with any suitable ball bearing motor which may be available. If repairs to the rotor should be necessary, it is unnecessary to disconnect the pipe connections to the pump.

Vertical centrifugal pump

Forced-convection heaters aid employee health



Stabilized Tramrail carrier

Improved self-cleaning strainer

Improved Strainer

IMPROVEMENTS in the design and in construction materials of the Brassert self-cleaning water strainer have greatly increased the scope of this equipment, according to S. P. Kinney Engineers, 233 Oliver Ave., Pittsburgh, Pa., exclusive sales engineers for Brassert products. This strainer, originally designed largely for fresh water use, is now being built of special materials for use in straining sea water and also for service at coke and similar plants for straining ammoniacal liquors.

For use on sea water, strainers are equipped with a Ni-Resist cone, chrome-nickel body and covers, admiralty metal ring gear and Monel metal liners, with stellite bushings and sleeves, stainless steel main shaft and pinion gear, stainless steel retainer rings and stainless or porcelain straining media. For ammoniacal liquor, the strainers employ a chrome-nickel body, cover and revolving drum casting, with a forged steel ring gear, stellite bushing and stainless pinion gear, together with stainless steel liners and retainer rings, and stainless steel or porcelain straining media.

As shown in the accompanying illustrations, this strainer consists essentially of a slowly rotating conical drum within a cast metal housing, the surface of the drum being drilled to receive straining media which consist of porcelain disks or stainless steel wire screens. Water to be strained passes inward into the rotating cone, the clean water discharging through an outlet at the bottom of the housing. The foreign matter in the water is retained on the straining elements, which are carried by the slow rotation of the drum to a backwash slot at which point a reversal of the flow of strained water takes place, clean water from inside the drum flushing the screening media and removing dirt from the strainer. These strainers are available in sizes for 3 to 30 in. pipe lines, for straining from 100 to 32,000 g.p.m.

Forced-Convection Heater

ACCORDING to General Electric Co., Schenectady, N. Y., forced-convection electric heaters are being used increasingly this winter in contributing to the health and comfort of industrial employees, such as the operators of electric locomotives and cranes, watchmen, and guards in towers. Automatically controlled heaters ranging from 2 to 15 kw. in capacity are available in the suspension type for wall and ceiling mounting. A portable type, intended primarily for floor mounting, is nevertheless readily adapted for either wall or ceiling use. These heaters are quickly and easily installed, since it is only necessary to connect them to the nearest electric outlet. Used industrially, they are said to contribute to efficiency through elimination of heat losses from pipe lines and elimination of the cost of running steam piping to remote points.

Stabilized Tramrail Carrier

A NEW SOLUTION to the problem of suspending a load rigidly through the use of the usual flexible hoisting ropes is offered by Cleveland Tramrail Div., The Cleveland Crane & Engineering Co., Wickliffe, Ohio, in the new patented arrangement of ropes shown in an accompanying illustration. The ropes form a triangular suspension, so that the load may be held rigidly in place so as to eliminate longitudinal, lateral and rotational sway. The new arrangement permits a load to be considerably unbalanced and still held rigidly in place. On the other hand, if desired, the load can be tilted in either direction with relation to the rail supporting the carrier. The stabilized carrier may be operated on two standard Cleveland Tramrails, on a double-girder Tramrail crane bridge, or on the regular type overhead rail, on either side of which are flat rails for the support of stabilizing rollers, as in the illustration.

Two-Pen Flow Recorder

FOR APPLICATIONS where it is desired to have two related flow records on the same chart for ready comparison, or

where space limitations makes two records desirable on the same recorder chart, the Cochrane Corp., 17th and Allegheny Aves., Philadelphia, Pa., has developed a new two-pen electric flowmeter which consists actually in two complete flowmeter receivers mounted within a single double-depth case. Both receiver mechanisms can be swung out and operate in the swung-out position.

Where two related measurements are involved, the operator can observe the relative position of the two pens, but this arrangement requires noting which pen is which. For cases where continual reference must be made to the relationship between two records, a ratio indicating pointer can be incorporated, having a clearly visible target which moves to left or right from the center point on the scale, over a dial above and outside the periphery of the recording chart. Since the movement of this pointer is two and one-half times greater than the difference between the two recording pens, the difference can be readily noted.

If desired, an integrating feature can be furnished for both mechanisms, but reading of the rear mechanism integrator requires opening the case and swinging the front mechanism forward.

Industrial Power Truck

MANY NEW FEATURES, including a fully automatic clutch and a self-shifting transmission, are found in the Salsbury Turret Truck, a new industrial power truck distributed by Nutting Truck & Caster Co., Faribault, Minn., and available in lift, cargo and tractor types. As shown in the accompanying illustration, the truck is distinctive in design, employing an engine-over-drive-wheel power assembly contained within a turret. Steering is done with the driving wheel, which provides ready maneuverability. The main frame of the power plant is rotated on ball bearings which permits steering in any direction over a 360 deg. arc. To reverse the direction of travel, the operator simply reverses the turret and drive wheel in one and the same motion. The Salsbury lift-type turret truck incorporates an articulated design which rides loads evenly over sharp dips, carrying the load practically level and eliminating danger of spilling.

In all three types, the power plant is a single-cylinder, four-cycle, air-cooled engine providing a maximum speed of 8 miles per hour under full load. Gear shifting is entirely automatic and provides instantly variable drive ratios between 60 to 1 in low, and 20 to 1 in high gear. Drive ratios are controlled by travel speed, an automatic clutch being provided which engages as the engine is accelerated, disengaging when the engine idles. One type is equipped with a foot-operated hydraulic lift for picking up loaded skids; another with a platform for carrying loads; and a third for pulling trailer trains.

Turret-type tractor truck

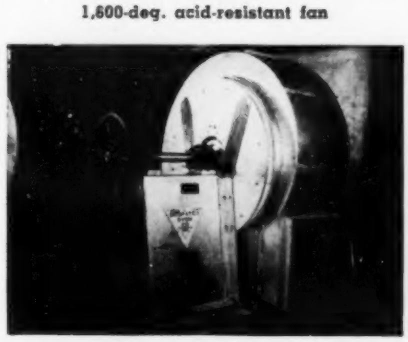
Heavy-duty air-driven mixers

Air-Driven Mixers

THREE new heavy-duty air-driven mixers have recently been added to the line of portable mixing equipment manufactured by Mixing Equipment Co., Rochester, N. Y. Two of these are gear-reduction models, while the third is a larger direct-drive model. These mixers are especially suited to the mixing of paint, chemicals, high explosives and alcohol compounds. Their air-driven motors cannot be overloaded or burned out, according to the manufacturer, and even when used in extremely heavy liquids, they cannot stall. The air exhaust from the motor is so arranged as to keep the motor running cool at all times. Models available include 1 hp. and 1/3 hp. With motors designed for a top speed of 1,800 r.p.m., the reduction models give top speeds respectively of 400 and 431 r.p.m., for Model AG-33 and AG-100. The first of these has two 8-in., the second two 12-in. propellers. Model AR-100, the direct-drive model, employs two 5-in. propellers operating at 1,800 r.p.m. Various metals such as stainless steel, plain steel, Monel and bronze may be used for the propellers and shafts.

Photoelectric color grader

1,600-deg. acid-resistant fan



Photoelectric Color Grader

FOR RAPID GRADING of color of rosin, other naval stores products, and other resins, Robert H. Osborn of the experiment station research laboratories of Hercules Powder Co. has developed a new photoelectric photometer which is now being used by the Hercules organization and has been made available to other manufacturers through a royalty-free license. The builder of this equipment is the Rubicon Co., Philadelphia, Pa.

The apparatus consists of a light source, colored glass filters and a photocell. The average time for a single meter reading is ½ min., as rapid as ordinary visual inspection by an expert color grader, but giving a result eliminating personal errors. A single meter reading indicates the ratio of transmissions of a rosin sample for light beams of two different colors. To permit tests on a wide range of transparent liquid or solid naval stores, the electrical circuit is so arranged that the instrument scale may be expanded or contracted. The instrument is also useful as a colorimeter.

Alloy Steel Fan

ACID-RESISTING, high-temperature fans of alloy steel, which have been used for the past seven years on this company's industrial furnaces and ovens, are now being offered separately for the first time by the Despatch Oven Co., Minneapolis, Minn. These fans, which are said to be suited to virtually all heavy-duty, high-volume requirements involving temperatures up to 1,600 deg. F., are precision-balanced to assure smooth, quiet operation under widely varying service conditions. The fans are made in 11 sizes ranging from 12-in. diameter wheels up to 48-in. wheels handling total pressures to 10 in. w.g. and capacities to 20,000 c.f.m. All models employ an overhung wheel and

V-belt drive, the shaft being supported on two large air-cooled bearings. A special device is used to dissipate heat from the shaft before it reaches the bearing. Various alloy steels can be supplied to permit handling a variety of corrosive materials at high temperatures.

Equipment Briefs

In step with the effort to conserve sheet steel for vital war needs, The Hays Corp., Michigan City, Ind., is now employing Masonite reinforced with steel angles for the manufacture of instrument and control panels. The body of the panel is made of cross-grained Masonite ⅜ in. thick, bolted to a frame-work of 3x3-in. angle steel, with braces of 2x2-in. angle steel to reinforce the center of the panel. The Masonite can be given a velvety finish comparable to that put on steel.

New lockers for clothing, and shelving for stockrooms, manufactured of wood as a steel-saving measure, have been announced by Ivel Corp., 211 West 61st St., New York, N. Y. The lockers are light in weight, made of plywood or pressed wood on a substantial frame. The shelving employs a new construction permitting secure engagement of members without the use of hardware and without employment of skilled labor.

New fluxes for the gas welding of magnesium and of aluminum and aluminum alloys have been announced by Park Stewart, 1019 Carbis St., Worthington, Pa. Mag-Na-Flo flux is suitable for gas-welding all alloys of magnesium, according to the manufacturer, while Flo-Ez-Flux is employed for gas-welding of aluminum and its alloys. Both types are packaged in glass containers to prevent corrosion and protect the flux from moisture, and both are available in sizes ranging from ¼ to 25 lb.

Bijur Lubricating Corp., Long Island City, N. Y., has announced a new window unit for oil level visibility for installation in built-in oil-reservoir castings. The unit consists essentially of a window of clear plastic, assembled in a polished metal housing which by means of a special assembly tool may readily be pressed into a reamed hole in the machine casting, providing the wall is ¼ in. thick or more. The bright background of the window housing provides sharp visibility of the oil level, according to the manufacturer.

A new line of solderless connectors and lugs for welding cables has been announced by National Cylinder Gas Co., 207 West Wacker Drive, Chicago, Ill. Speed of application, full protection of the cables and conservation of vital materials are advantages of the new Cable-Tite connectors.

Among new wartime uses for rayon is the recently announced application of this material as a mechanical packing to seal against the entrance or escape of water, brine, oils and other fluids. According to the Rayon Department of E. I. duPont de Nemours & Co., rayon tow is now serving as well or better in many applications than the packings this material has replaced. Rayon tow consists of an untwisted rope of many thousands of continuous filaments of viscose rayon. The grade known as Type 126, which is that used by manufacturers of mechanical packings, is braided and impregnated with lubricant before it is used for packing purposes.

Industrial Products Co., 2820 North Fourth St., Philadelphia, Pa., has announced a new safety cradle for drums and barrels, to provide safe and easy handling of these containers. Rotating wheels at the top of the frame allow drums and barrels to be easily and quickly put into position for removing part of the liquid, or for draining. Wheels and swivel castors are of a large diameter, heavy-duty type, so that the unit may be moved to the desired location with comparative ease.

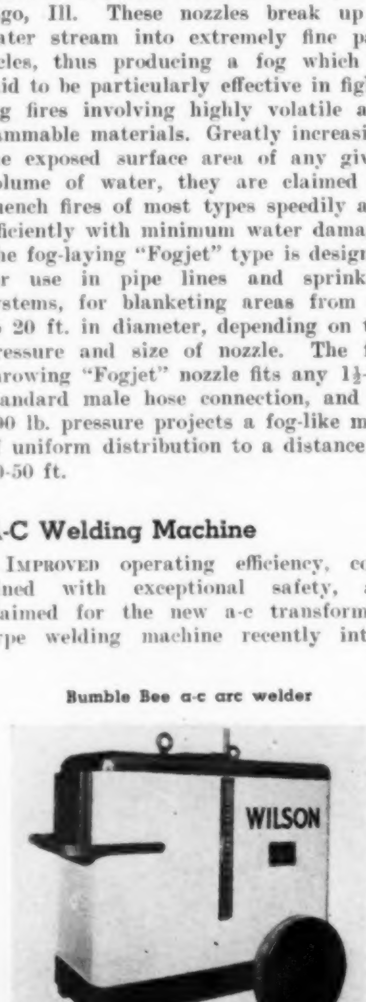
Fog Nozzle

New fire-fighting nozzles of both the fog laying and fog throwing type have recently been announced by Spraying Systems Co., 4023 West Lake St., Chicago, Ill. These nozzles break up a water stream into extremely fine particles, thus producing a fog which is said to be particularly effective in fighting fires involving highly volatile and flammable materials. Greatly increasing the exposed surface area of any given volume of water, they are claimed to quench fires of most types speedily and efficiently with minimum water damage. The fog-laying "Fogjet" type is designed for use in pipe lines and sprinkler systems, for blanketing areas from 12 to 20 ft. in diameter, depending on the pressure and size of nozzle. The fog throwing "Fogjet" nozzle fits any 1½-in. standard male hose connection, and at 100 lb. pressure projects a fog-like mist of uniform distribution to a distance of 40-50 ft.

A-C Welding Machine

Improved operating efficiency, combined with exceptional safety, are claimed for the new a-c transformer-type welding machine recently introduced by Wilson Welder & Metals Co., 60 East 42d St., New York, N. Y. The most interesting feature of the new Bumble Bee welder is its low open-circuit voltage of 42 volts, which is automatically and positively maintained. The new welder uses two primary coils instead of the usual one. There is a magnetic contactor in the circuit of one primary. Each primary contributes approximately 42 volts to the open-circuit voltage, which is actually 84-85 volts. However, when the machine is idle, one primary is automatically cut out, restricting the open-circuit value to 42 volts. As soon as the electrode contacts the work, however, the second primary is thrown into the circuit. Thus, when the operator draws an arc, the open-circuit potential of 84-85 volts enables him to establish the arc quickly and begin welding. Most welding operations are performed between 32 and 40 volts. When welding is completed and the operator lengthens his arc, the arc voltage rises and when it reaches 45 volts, the contactor opens and cuts out one primary.

Bumble Bee a-c arc welder



Ready-Mixed Floor Patch

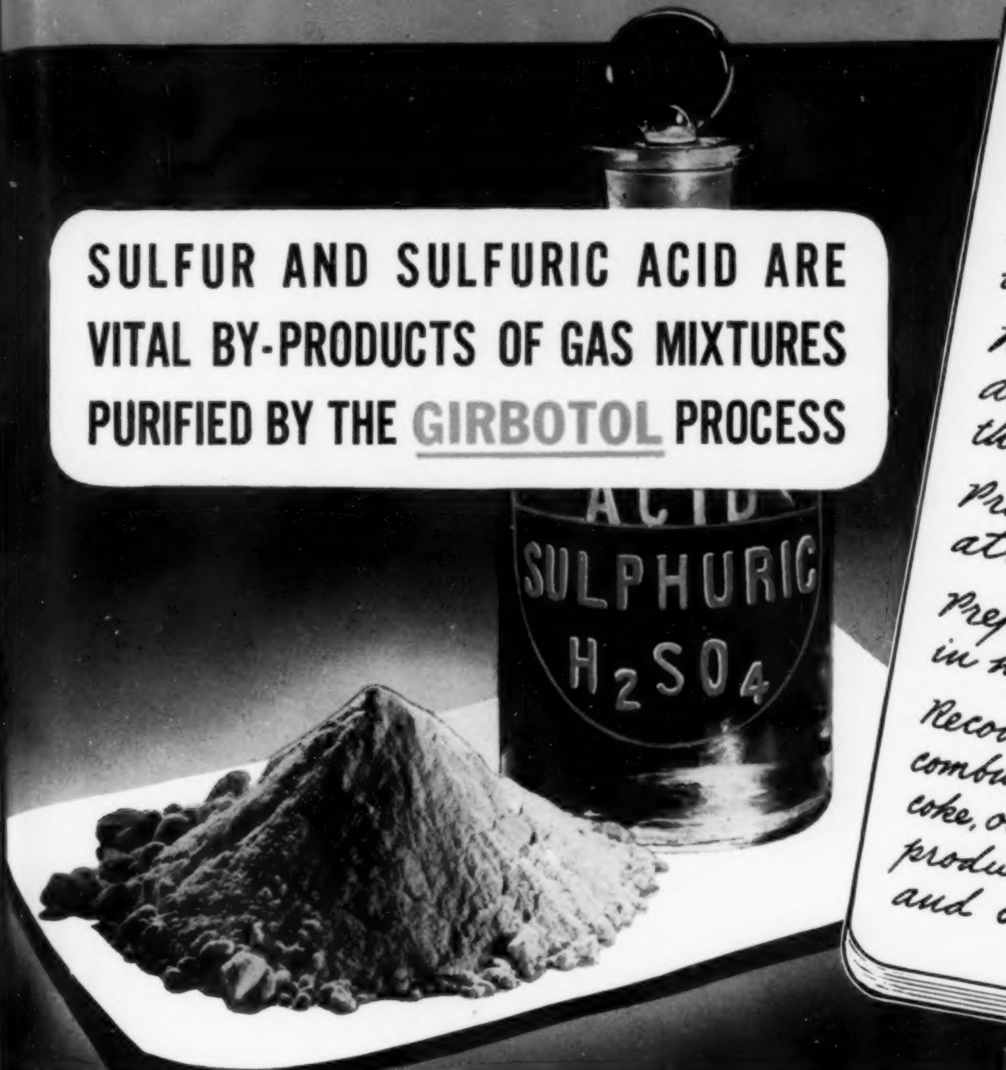
For quick repair of ruts and holes in floors, and their immediate re-use, the Flexrock Co., 23d and Manning Sts., Philadelphia, Pa., has introduced a new product, Instantuse, a ready-mixed floor patch which can be applied readily by anyone without special skill. Rough floors can be patched in the midst of traffic. The hole is swept, then primed and the material shoveled in and tamped into place. The material is resilient and sparkproof and is said to hold tight to old concrete without difficulty, smoothing out to a fine feather edge.

Fog-laying Fogjet nozzle

Floor patch takes traffic immediately

ENGINEERING NOTES ON **GIRBOTOL** GAS PURIFICATION

SULFUR AND SULFURIC ACID ARE VITAL BY-PRODUCTS OF GAS MIXTURES PURIFIED BY THE GIRBOTOL PROCESS



Other Girbotol uses:

Protection of catalysts against injury by H_2S in several processes.

Removal of CO_2 before ammonia synthesis in the manufacture of munitions.

Production of inert atmospheres.

Preparation of hydrogen in hydrogenation processes.

Recovery of CO_2 from combustion gases such as coal, coke, oil and natural gas for production of liquid CO_2 and dry ice.

• If the removal of hydrogen sulfide from the gaseous or liquid mixtures in any of your processes is desirable, you should consider the commercial possibilities of recovering this by-product, H_2S, for sulfur and sulfuric acid production.

Or if you use sulfur in any of your processes, hydrogen sulfide usually can be recovered much more cheaply than sulfur can be purchased. Hydrogen sulfide can readily be burned to sulfur dioxide which is converted to sulfuric acid. The conversion of H_2S to free sulfur has been carried on commercially abroad for several years, and recently has been operated successfully in this country.

The Girbotol Process removes and recovers acidic constituents from gaseous or liquid mixtures and does the job more *completely* and at *less cost* than any other method known today.

The Girbotol Process offers several interesting and valuable advantages in addition to scrubbing and recovering H_2S and CO_2. It offers simultaneous dehydration, is equally effective with *high* and *low* H_2S or CO_2 contents. Plants are available in six *standard* sizes, as well as in large, individually engineered units.

Write today for further information about the Girbotol Process.

Processes for

Production, Purification, Separation, Reforming or Dehydration of

HYDROGEN SULFIDE
CARBON MONOXIDE
BLUE WATER GAS
ORGANIC SULFUR
CARBON DIOXIDE
HYDROCARBONS
HYDROGEN
NITROGEN
OXYGEN

and various mixtures.

The GIRDLER CORPORATION

GAS PROCESSES DIVISION • LOUISVILLE, KY.

SPECIALISTS IN BETTER GAS PROCESSES

Production of Silica Aerogel

The first large scale production unit for silica aerogel has recently commenced operations at the plant of Monsanto Chemical Co. at Boston, Mass. The product is a light, friable, slightly opalescent solid containing as much as 95 percent air volume. It is a very effective heat insulating material. Silica aerogels having densities as low as 1.8 lb. per cu.ft. have been produced.

The process consists of adding a solution of sodium silicate to sulphuric acid. Concentrations are controlled to yield a gel having 8 percent silica. After aging several hours to allow the gel to strengthen, due to syneresis phenomena, it is removed from the tank and passed through the roll crusher into one of four wash tanks. Water is passed up through this tank over the gel to remove the sodium sulphate formed in the gel preparation reaction. When the gel has been sufficiently washed, all excess water is removed by draining and the gel is then covered with alcohol. After a suitable soaking time the alcohol is drained off and replaced with a fresh portion. The alcohol washing procedure is done by the use of a conventional 4-stage counter-current system. Greater economy of alcohol is realized by using the cover, soak and drain method of washing in place of continuous flow through the tanks. The counter-current cycle is facilitated by use of the wash receivers and the transfer pump. Weak alcohol taken from the system is recovered as strong alcohol by fractionation in a recovery column.

When the water in the gel has been substantially replaced with alcohol, the excess alcohol is drained off and the gel charged to the autoclave. Here it is heated to 550 deg. F., the pressure being held to 1150 lb. gage by bleeding off alcohol vapor through the condenser. When 550 deg. F. is reached the pressure is reduced to atmospheric and the autoclave is finally evacuated to 20 in. mercury for 10 min. The resultant aerogel is then removed by a conveyor system. The autoclave is heated by a jacket containing diphenyl vapor at 80 lb. gage pressure, this vapor being supplied by the oil fired diphenyl boiler.

The process is built around one essential unit operation involving a unique step, i.e., the heating of a gel system to temperatures and pressures above the critical for the liquid phase present in the gel.

CHEMICAL & METALLURGICAL ENGINEERING

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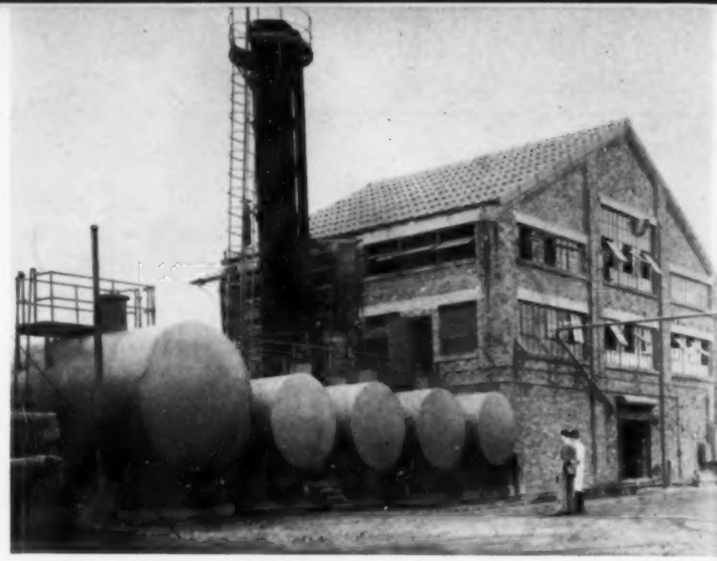
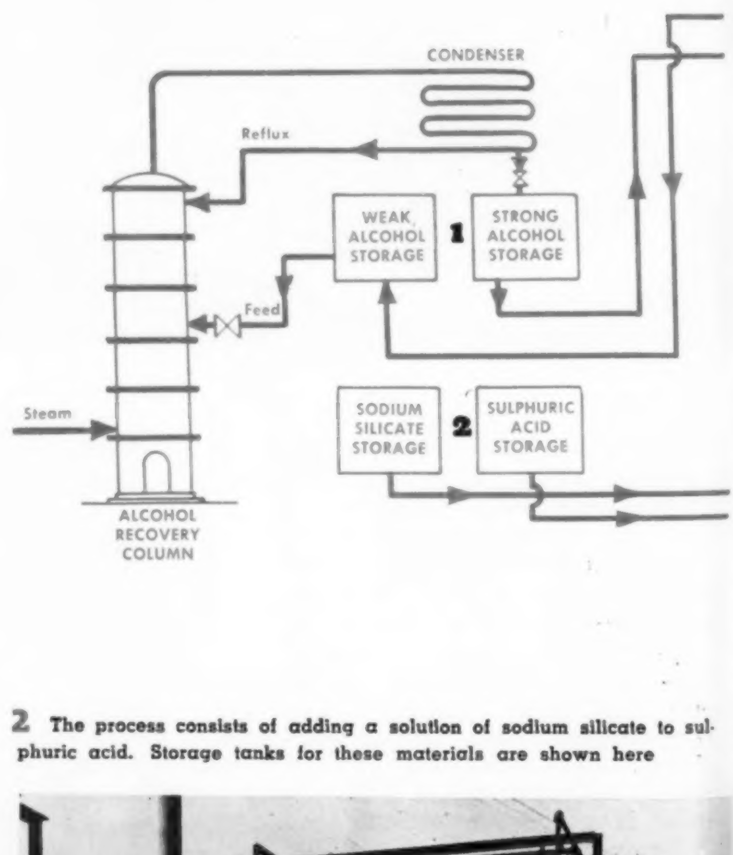
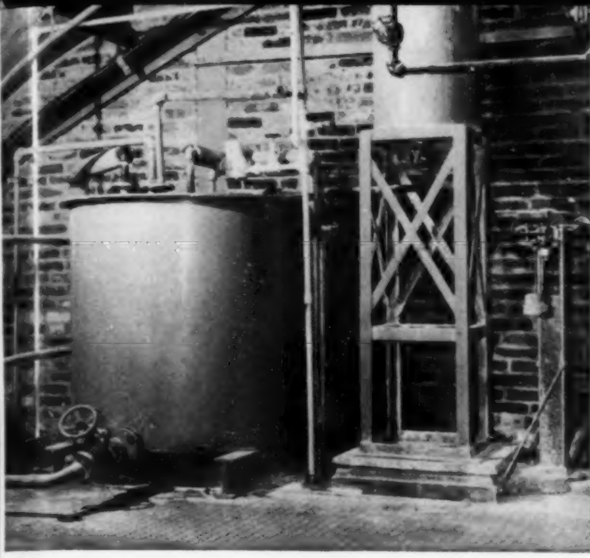


1 First large-scale production unit for silica aerogel has been completed at Boston. Alcohol storage tanks in foreground

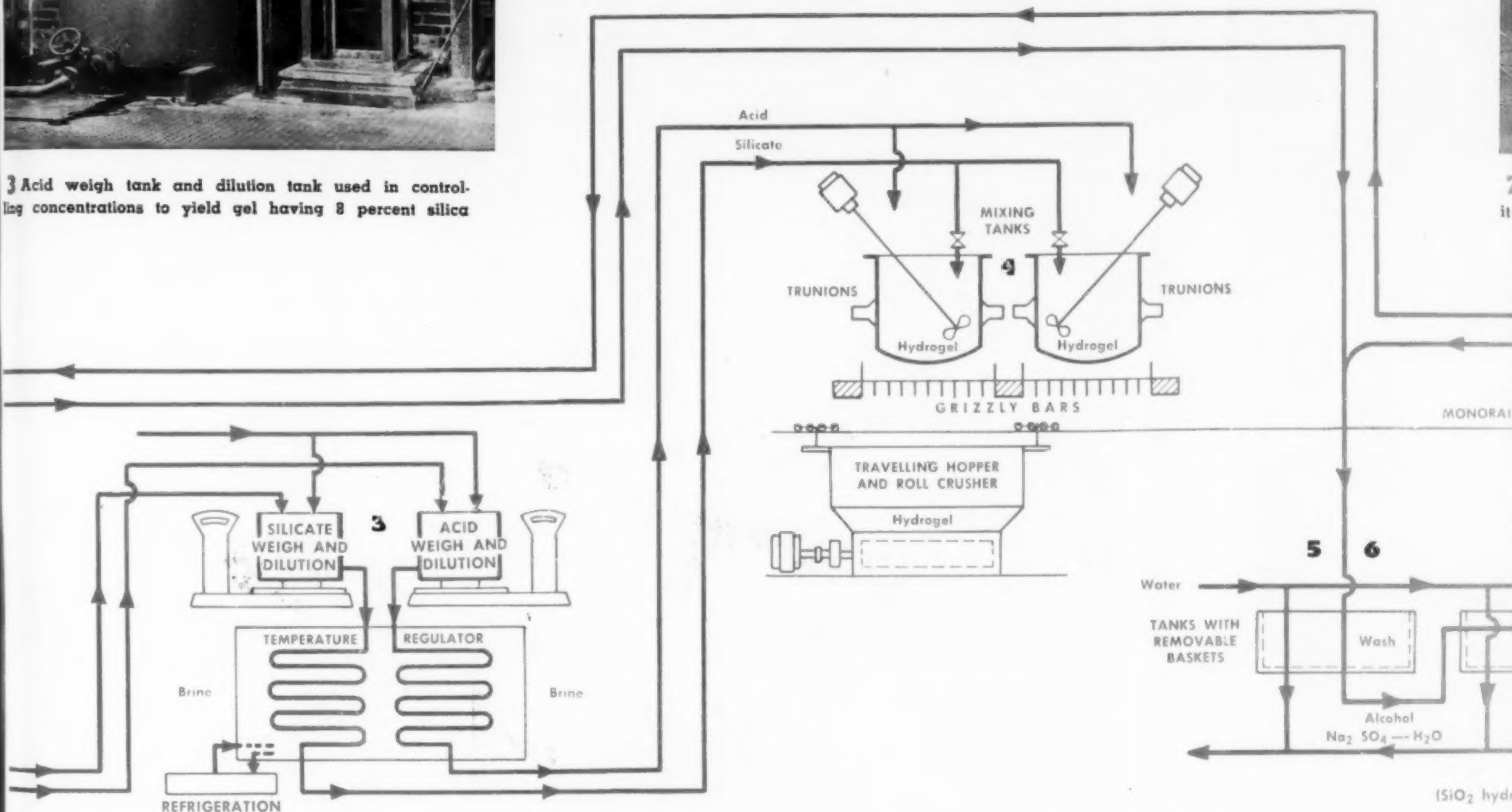


2 The process consists of adding a solution of sodium silicate to sulphuric acid. Storage tanks for these materials are shown here



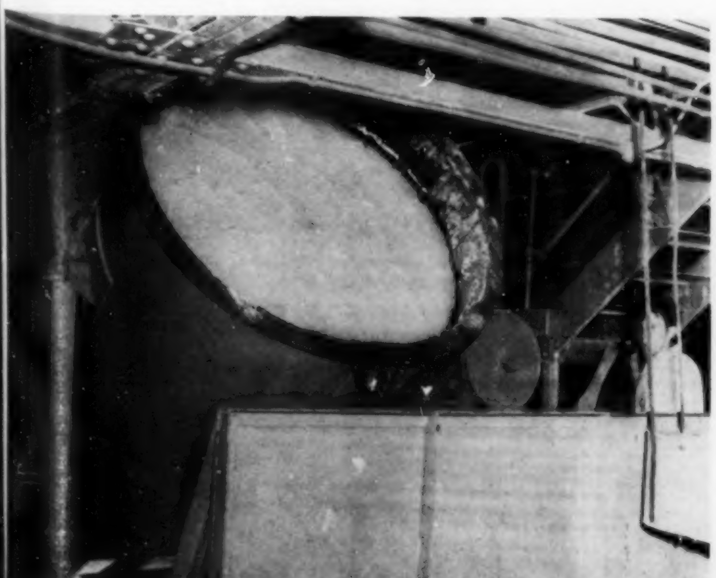
3 Acid weigh tank and dilution tank used in controlling concentrations to yield gel having 8 percent silica

A
Chem & Met
FLOW SHEET

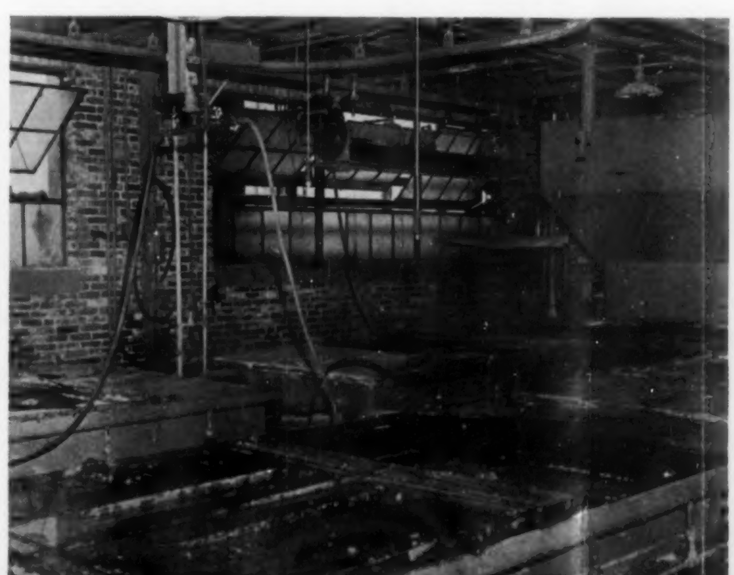


7
it

4 After aging several hours it is removed from the tank and passed through the roll crusher into one of four wash tanks

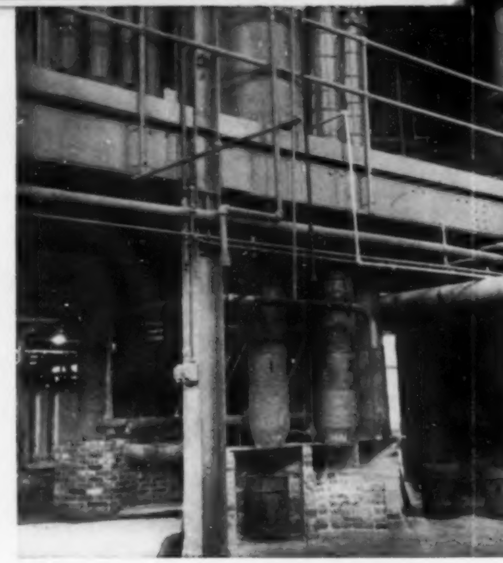


5 Water is passed up through these wash tanks over the gel to remove sodium sulphate formed. Traveling roll hopper in background

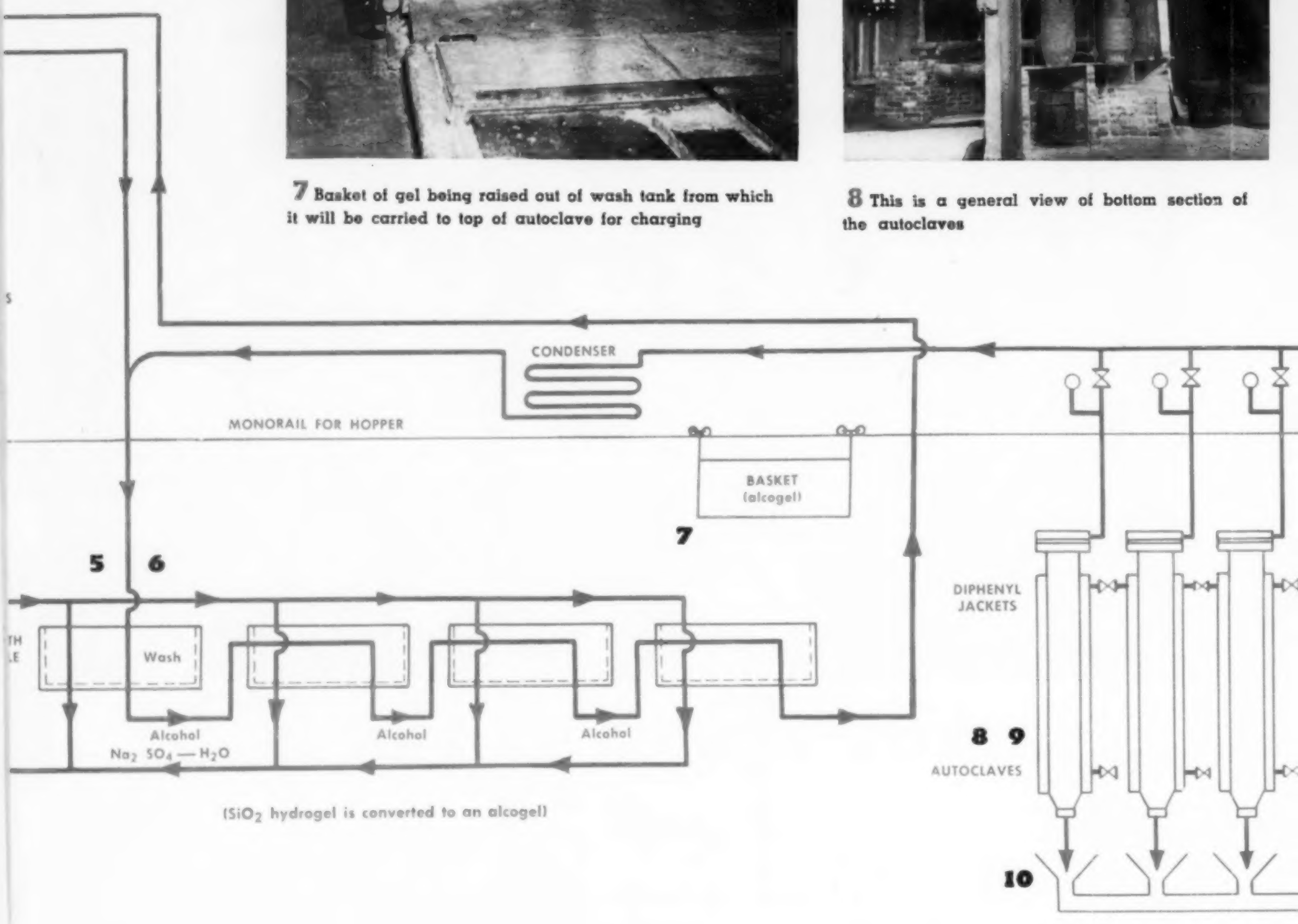


6 The alcohol washing proc
rent system. Excess alcohol

7 Basket of gel being raised out of wash tank from which it will be carried to top of autoclave for charging

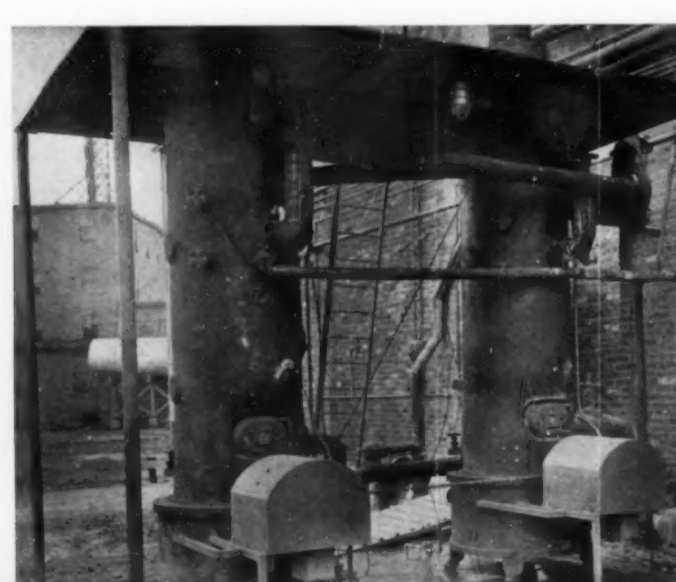


8 This is a general view of bottom section of the autoclaves



6 The alcohol washing procedure is done by a four-stage counter-current system. Excess alcohol has been drained off at this stage

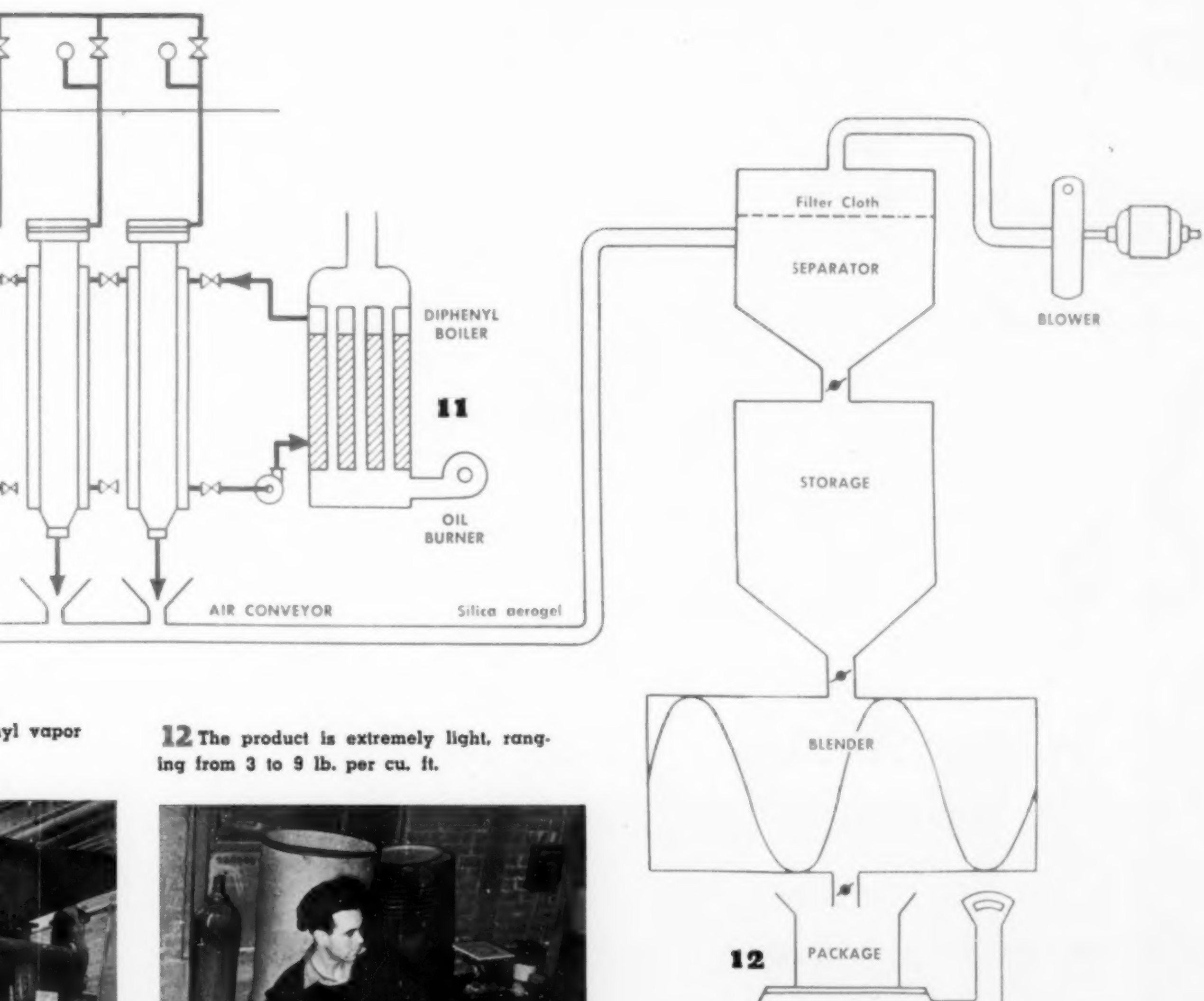
11 Autoclaves are heated by jackets containing diphenyl vapor at 80 lb. pressure. The boilers are shown



ction of

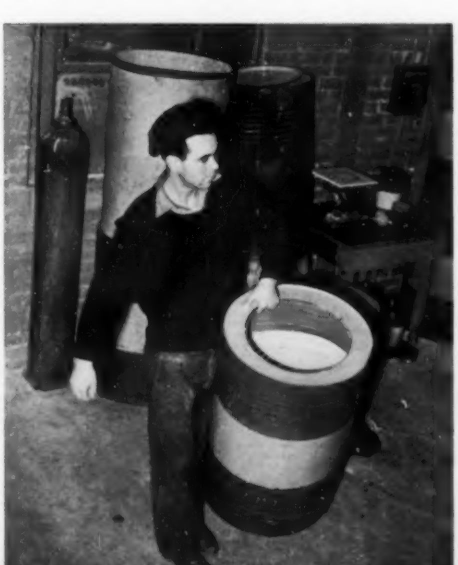
9 When 550 deg. is reached the pressure in the autoclaves is reduced to atmospheric and the autoclave evacuated

10 Discharging an autoclave. The aerogel is then removed by an air conveying system

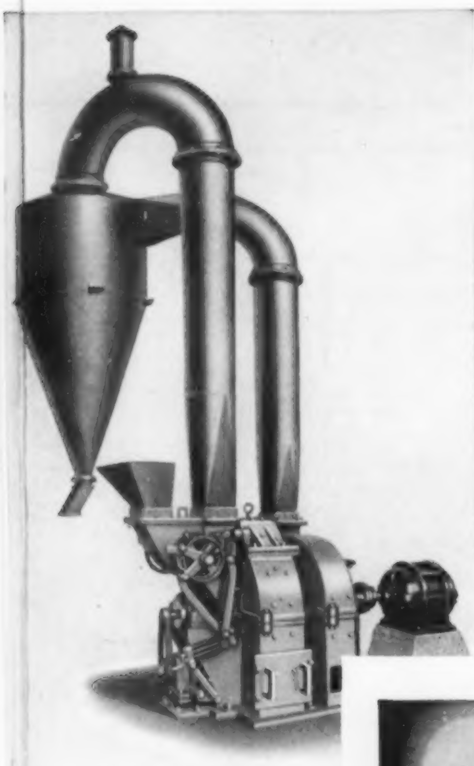


yl vapor

12 The product is extremely light, ranging from 3 to 9 lb. per cu. ft.



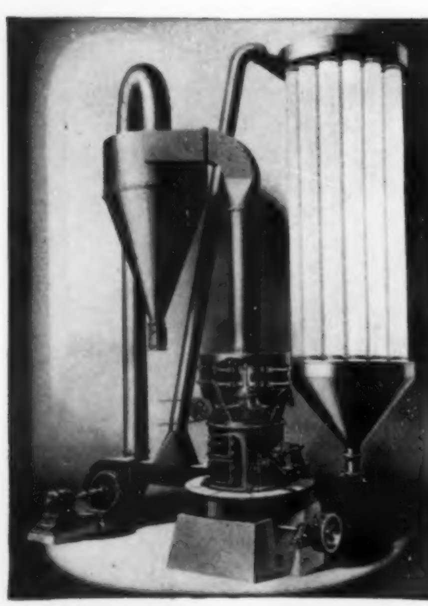
PRODUCING... *Intimate* MIXTURES



RAYMOND
Imp Mill

RAYMOND Mills with Air Separation provide a positive method of obtaining a complete and thorough intermixture of ingredients in finely powdered form.

Raymond Roller Mills, Imp Mills and Screen Pulverizers have been used as standard equipment for years in blending operations on various materials. With suitable feeders for proportioning the several ingredients to the mill, the finished product is delivered with an intimate dispersion of the particles, in the proper proportions and to specified fineness.

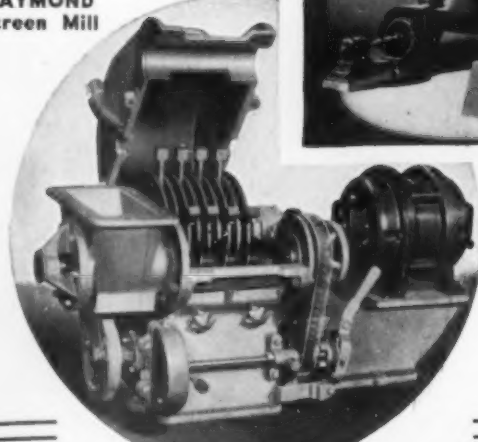


RAYMOND
Roller Mill

The Raymond system both with and without air separation is successfully used in blending the various ingredients used in face powders . . . mixing of conditioning and wetting agents when grinding sulphur for insecticide spray purposes . . . blending pigments . . . making food product mixtures . . . introducing flavoring media, extenders and free-flowing admixtures.

Other recent applications include grinding of coal and salt mixtures, coal and pitch, and other combinations. If you have a special problem in grinding and blending, let Raymond engineers aid you in getting accurate and economical results.

RAYMOND
Screen Mill



RAYMOND PULVERIZER DIVISION
COMBUSTION ENGINEERING CO., INC.
1311 North Branch Street, CHICAGO
Sale Offices in all Principal Cities
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Chemical Engineering NEWS

INDUSTRIAL RESEARCH MEN MEET IN PHILADELPHIA

The importance of research, both to the war effort and to our development after the war, was given special emphasis at the meeting of the Industrial Research Institute in Philadelphia, Jan. 22-23 at the Hotel Warwick. At the opening session W. C. Stevenson, chief, Laboratories and Technical Equipment Section, Safety and Technical Equipment Division, WPB, described regulations that affect supply of materials and equipment for research laboratories. He explained how to take advantage of the special concessions that have been secured for research laboratories under the Production Requirements Plan and the Controlled Materials Plan that is supplanting it.

R. C. Newton, vice-president, Swift & Co., lead a discussion on post war planning and the research laboratory. It was brought out that, without slackening their all-out war effort, many industrial concerns are today giving some organized study to post war problems and how to meet them. As a departure from their practice of spot lighting the faults of their research organizations the members spent a little time in self analysis at this meeting. They were aided by Arthur J. Slade of Rogers & Slade, New York, who outlined what the president of a company wants in his director of research and development and presented a set of specifications he had formulated from suggestions made to him by a number of company presidents.

A symposium on new research tools and their applications was conducted in place of the usual visit to a local plant or laboratory. This comprised talks, illustrated by movies and slides, on high speed photography by Prof. Harold E. Edgerton, Massachusetts Institute of Technology, and F. Nickel, Jr., Western Electric Co., New York, and on the electron microscope by M. C. Banca, Radio Corp., of America, Camden.

The possibilities and limitations of job evaluation procedures, as applied to research organizations, were discussed at simultaneous group conferences under the leadership of F. W. Blair, chemical director, The Procter and Gamble Co., Ivorydale, Ohio; J. N. Dow, technical director, Bigelow Sanford Carpet Co., Thompsonville, Conn.; J. M. McIlvain, administrative supervisor, Research and Development Department. The Atlantic Refining Co., Philadelphia and R. S. Taylor, chief engineer, Servel, Inc., Evansville, Ind. Following this A. G. Ashcroft, product engineer, Alexander Smith & Sons Carpet Co., Yonkers, and chairman of a special IRI committee on the education, selection and training of research personnel presented the results of an inter-laboratory study of scientific aptitude and vocabulary tests for research personnel. A business meeting of the Institute concluded the formal program.

NEW BUTADIENE PRODUCTION AT BATON ROUGE

The Standard Oil Co. at the close of January announced that its new plant for the production of butadiene at Baton Rouge, La. had been placed in full operation. This is the first of the butadiene plants which are to produce material from petroleum for the government's synthetic rubber program. The plant has a rated capacity of 6,600 tons to 9,000 tons of butadiene a year depending upon the quality of petroleum fractions used as feed stock in the plant. Work had been started on the plant prior to Pearl Harbor and it was planned by the Standard Oil Co. of La. to supply it with butadiene to increase its own production of special types of synthetic rubber.

The plant had been scheduled for completion in October 1942 but shortages of critical construction materials delayed the work. Three additional butadiene units at Baton Rouge which are being wholly or partly financed by the Government are moving toward completion.

DUPONT WILL GIVE TWENTY-TWO POSTGRADUATE FELLOWSHIPS

E. I. du Pont de Nemours & Co. has announced the award of twenty-two postgraduate fellowships for research in the field of chemistry for the academic year 1943-44. Appointments to these fellowships, which carry $750 each, will be made later in the year by the heads of the chemistry departments of the several colleges and universities to which grants have been made.

Fellowships for advanced work in chemistry were established by the du Pont company in 1918, when there was a scarcity of well trained chemists. Through this plan the company sought to encourage promising students to follow a career in chemical research. Originally, only men were considered, but to increase the number of available candidates the committee now recommends that women be admitted to candidacy on the same basis as men.

CHLORINE INSTITUTE HOLDS ANNUAL MEETING

The annual meeting and directors meeting of the Chlorine Institute, Inc., was held at the Chemists' Club, New York, on Jan. 27. The following directors were elected for two years: Thomas Coyle, E. I. duPont de Nemours & Co., Electrochemicals Department; W. I. Galliher, Pittsburgh Plate Glass Co., Columbia Chemical Division; L. Neuberg, Westvaco Chlorine Products Corp.; E. E. Routh, The Mathieson Alkali Works, Inc.; B. P. Steele, Pennsylvania Salt Mfg. Co.; and Eli Winkler, Southern Alkali Corp. Hold-over directors are: G. S. Cooper, Diamond Alkali Co.; R. W. Hooker, Hooker Electrochemical Co.; S. W. Jacobs, Niagara Alkali Co.; E. C. Speiden, Isco Chemical Division, Innis, Speiden & Co.; and I. H. Taylor, Wyandotte Chemical Co.

At the directors meeting which followed the annual meeting, the following officers were elected: S. W. Jacobs, president; E. C. Speiden, vice-president; and Robert T. Baldwin, secretary and treasurer.

NEW CHEMICAL INDUSTRY ADVISORY COMMITTEE

An advisory committee on ethylene dichloride was recently formed with J. C. Leppart as the government presiding officer. Industry members include L. I. Doan, Dow Chemical Co., J. W. McLaughlin, Carbide & Carbon Chemicals Corp., Glenn Haskell, U. S. Industrial Alcohol Co., and J. H. Schaifer, Ethyl Corp.

A chromium chemicals committee also was selected with M. R. Stanley as government presiding officer. Other members are G. A. Benington, Mutual Chemical Co., H. A. Goman, Natural Products Refining Co., A. F. Brown, Imperial Paper & Color Co., C. D. Marlatt, The Martin Dennis Co., and H. B. Prior, Prior Chemical Co.

GENERAL ANILINE & FILM OPENS NEW RESEARCH LABORATORY

General Aniline & Film Corp.'s new research laboratory at Easton, Pa., is now in operation. A staff of fifty technologists, later to be increased in number, will work in the laboratory under the direction of Dr. E. C. Williams, chemical director and vice-president of the corporation, and formerly head of the Shell research laboratory at Emeryville, Calif.

CHEMICAL PRODUCERS EXEMPT FROM FUEL OIL RESTRICTION

The Petroleum Administration for War, upon the advice of the War Production Board, on Feb. 5 included the production of 36 chemicals in the list of Schedule "A" Operations under Petroleum Distribution Order No. 3, which was issued on January 18, 1943.

The PAW's Distribution Order No. 3, as implemented by the Office of Price Administration Ration Order No. 11 (amended), imposed a 40 percent cut for the current three-month period in the amount of fuel oil allowed to certain large consumers for uses other than space heating and hot-water purposes. Schedule "A" of PAW's Distribution Order No. 3 is the list of operations to which the 40 percent cut does not apply, provided the fuel oil used for other than space heating or hot water is used exclusively for those specific operations.

The effect of the amendment is to exempt the producers of chemicals from the 40 percent cut where the fuel oil is used exclusively in production of the following chemicals: Acrylates, acrylonitrile, ammonium nitrate, ascorbic acid, atabrin, benzol, biological products (vaccines, serums, etc.), butyl alcohol, butyral resins, carbonyl iron, chemical cotton pulp, chlor sulfonic acid, ethyl alcohol, ethyl cellulose, fabric coating plants to the extent required to fulfill Army and Navy contracts, formaldehyde, isopropyl alcohol, lithium and lithium salts, nitrocellulose, oleum, phenol, phenolic resins, phthalic anhydride, polyvinyl resins, quinine, silica gel catalysts, sodium acetate, sorbitol, strontium chemicals, sulfa drugs, tega film, toluol, varnished cambric, vinyl acetate, vitamins and zinc chromate.

PLANS FOR BUTADIENE PLANT IN ILLINOIS CANCELLED

On Feb. 3, deputy rubber director, Col. Bradley Dewey announced the cancellation of a proposed plant for butadiene at Wood River, Ill. On the recommendation of the Petroleum Administrator it had been decided to convert a refinery of the Standard Oil Co. of Indiana at Wood River to a plant for making butadiene using the Houdry process. Favorable consideration also had been given to this project because it was believed the conversion could be completed by May 15. Because of shortages in various critical components, particularly some turbo-blowers, it was found that the plant would not be ready for operation before November and all plans for going ahead were cancelled.

SOAP AND GLYCERINE MEN ELECT E. H. LITTLE PRESIDENT

At the annual meeting of the Association of American Soap and Glycerine Producers, E. H. Little, president of Colgate-Palmolive-Peet Co., was elected president of the association. He succeeds R. R. Deupree, president of the Procter & Gamble Co. Vice-presidents selected were F. A. Countway, president of Lever Brothers Co., D. M. Flick, vice-president of Armour & Co., and F. H. Merrill, president of Los Angeles Soap Co. N. S. Dahl of John T. Stanley Co. was reelected treasurer and A. Roy Robson of Fels & Co. was elected assistant treasurer. The manager of the association, Roscoe C. Edlund was also elected secretary.

FOR PRODUCTION EXCELLENCE

Among the companies which, in the past month, have been awarded the honorary Navy "E" and Joint Army and Navy "E" burgee for exceeding all production expectations in view of the facilities at their command, are included the chemical and explosives plants, the chemical process industries and the chemical engineering equipment concerns listed below. Other process and equipment plants will be mentioned in these columns as the awards are presented to the individual plants.

Anderson Brass Works, Birmingham, Ala.
Atlantic Products Corp., Trenton, N. J.
Babcock & Wilcox Tube Co., Beaver Falls, Pa.
Bethlehem Steel Co., Baltimore, Md.
Borg-Warner Corp., Long Mfg. Division, Detroit, and Pump Engineering Service Division, Cleveland.
Boston Gear Works, North Quincy, Mass.
Chicago-Latrobe Twist & Drill Works, Chicago, Ill.
Columbian Steel Tank Co., Kansas City, Mo.
Copco Steel & Engineering Corp., Detroit, Mich.
Corning Glass Works, Corning, N. Y.
Darby Products of Steel Plate Corp., Kansas City, Kans.
Edison-Splitdorf Corp., West Orange, N. J.
The Electronic Laboratories, Indianapolis, Ind.
Engineering & Research Corp., Riverdale, Md.
Farrell-Cheek Steel Co., Sandusky, Ohio.
Formica Insulation Co., Cincinnati, Ohio.
General Electric X-Ray Corp., Chicago, Ill.
Illinois Gear & Machine Co., Chicago, Ill.
Lindberg Engineering Co., Chicago, Ill.
Markey Machinery Co., Seattle, Wash.
Masonite Corp., Laurel, Miss.
Mathieson Alkali Works, Niagara Falls, N. Y.
Merck & Co., Rahway, N. J.
Michigan Seamless Tube Co., South Lyon, Mich.
Missouri Valley Bridge & Iron Co., Leavenworth, Kans.
Monroe Steel Castings Co., Monroe, Mich.
National Carbon Co., Bennington, Vt.
Otis Elevator Co., Buffalo Works, Buffalo, N. Y.
Oregon Brass Works, Portland, Ore.
Parke, Davis & Co., Detroit, Mich.
Penn Electric Switch Co., Goshen, Ind.
Philadelphia Insulated Wire Co., Philadelphia, Pa.
Portland Forge & Foundry Co., Portland, Ind.
Revere Copper & Brass Co., Detroit, Mich.
Rex Mfg. Co., Connersville, Ind.
Rock River Woolen Mills, Jonesville, Wis.
Spencer Lens Co., Buffalo and Cheektowaga, N. Y.
Standard Oil Co. of Calif., Richmond, Calif.
Stow Mfg. Co., Binghamton, N. Y.
Talon, Inc., Plant No. 4, Meadsville, Pa.
Thibedeaux Boiler Works, Thibedeaux, La.
Tokheim Oil Tank & Pump Co., Fort Wayne, Ind.
Union Asbestos & Rubber Co., Cicero Plant, Chicago, Ill.
Webber Gage Co., Cleveland, Ohio.
Western Gear Works, Seattle, Wash.
Worthington Pump & Machinery Corp., Moore Steam Turbine Division, Wellsville, N. Y.

CORNELL OFFERS SCHOLARSHIPS IN ENGINEERING

To aid a select group of students to secure special preparation for military service or war industry, Cornell University will again offer 30 or more John McMullen Regional Scholarships in Engineering to men qualified to enter the College of Engineering in June or September. These scholarships pay up to $200 each term, normally $400 a year but now $600 a year if the student elects the three-term accelerated program.

Application must be received by March 1, and candidates who receive final consideration are required to take the Scholastic Aptitude Test of the College Entrance Examination Board. Fields of study open to applicants include chemical, civil, electrical, mechanical and administrative engineering.

H. E. THOMAS HEADS COMPRESSED GAS MFRS.' ASSOCIATION

At the thirtieth annual meeting of the Compressed Gas Manufacturers' Association, held at the Waldorf-Astoria, New York, on Jan. 25-26, H. Emerson Thomas of Westfield, N. J., was elected president for the ensuing year. Other officers elected were Thomas Coyle, electrochemicals department, E. I. du Pont de Nemours & Co., first vice-president and Robert J. Quinn, Mathieson Alkali Works, second vice-president. F. R. Featherson, secretary-treasurer of the association is now serving with the Chemical Warfare Service and in his absence his position will be filled by Miss Florence Jacobs.

DIAKEL CORP. WILL OPERATE DEFENSE CORP. PLANT

A contract has been signed by Diakel Corp., Cincinnati, and Defense Plant Corp. to provide plant facilities adjacent to the present plant of Diamond Alkali Co., Standard Silicate Division. The estimated cost of the plant is in excess of $2,000,000.00. Diakel Corp. will operate the plant, although title will remain in Defense Plant Corp.

Diakel Corp. was incorporated recently in Ohio, and is owned jointly by Diamond Alkali Co., Pittsburgh, and M. W. Kellogg Co., New York. The latter company is designing and building the plant. It is understood that when completed it will be used as manufacturing facilities in the war program.

WESTINGHOUSE FELLOWSHIPS OUT FOR DURATION

The Westinghouse Electric and Mfg. Co. has discontinued for the duration of the war the Research Fellowships awarded annually during the past five years to enable young scientists to continue their studies at the company's research laboratories in East Pittsburgh. Like the 25 principal manufacturing plants of the company, the research laboratories are concentrating on getting the war job done quickly. Pure research, as such, is being pursued only in instances where it helps the war effort.

WASHINGTON NEWS

Rubber Director Jeffers won the first round of his battle for priorities. In so doing he secured authority for the immediate completion of virtually one-half of the plants for the production of synthetic rubber. The skirmish is indicative of the manner in which things are handled in Washington today—rule by pressure.

Fifteen months ago, following the attack on Pearl Harbor, there was a mad scramble to get going full speed with the war program. Plants were built rapidly. In some industries too many plants were put up and in others capacities were over-built because the details could not be worked out in the short time available. Every manufacturer in the country was after all the raw material that he could lay hands on whether it was for the manufacture of goods for war or civilian supply.

Industries like the motor truck manufacturers, where the change from peace time production to war production required little adjustment of the plant began turning out goods in tremendous volume long before manufacturers who had taken on new war items, tanks for instance, could get into production. An almost unbelievable dislocation of the war program and the raw material supply resulted.

Nationally, the nation is still in the throes of the heroic measures that had to be taken to straighten out the inventory situation and to schedule production. The production programs for ships, tanks and guns were balanced one against the other and were cut to fit the available raw material. We have now reached the place where all raw material has been allocated to the various programs. When the fortunes of war force a new and unforeseen emergency program the material for that purpose must be taken from some other program. There is no other place to get it. The same occurs when it becomes necessary to speed up a single program in relation to the rest.

When material from one program is transferred to another it does not mean a change in the final goal of the program that loses the material. It means merely a delay. In fact the losing program may get back on schedule before the final completion date, particularly if the program is for an item already in production. When it is a program of plant construction the problem is different. The loss of time is much more likely to be permanent.

At the moment there are several programs that are "musts"—high octane gasoline for aviation, escort vessels, rubber, merchant ships, etc. These programs are competing for raw materials and for component parts, a term much used in Washington at present and meaning completely fabricated items that have many applications, such as electric motors, compressors, heat exchangers, and the like. Pressures that are built up to get this or that program speeded up are the pressures that are presently the ruling force in war production.

First progress report of the Rubber Director (*Chem. and Met.*, Jan. 1943, page 85) emphasized the danger of any delay in the delivery of components for synthetic rubber plants. When the pressure put on the construction of escort vessels and 100 octane gasoline plants threatened to divert some of the components from the rubber plants and to jeopardize the rubber schedule Mr. Jeffers objected so strenuously that Donald Nelson finally had to turn the matter over to the White House for final decision.

Result was a clear cut directive that gave rubber priorities for the immediate completion of enough capacity to meet the minimum requirements for 1943. The figure reported is roughly about 55 percent of the program for Buna S and smaller amounts for other types. Mr. Jeffers finally agreed to "find a way" to get by on that part of the program.

Donald Nelson's statement before a congressional committee that he and Jeffers were in disagreement on the amount of production capacity that should be finished at once shoold not be taken too seriously. It is one of the important duties of the Rubber Director to disagree violently with anyone who proposes anything that would slow up the rubber program in any way. Mr. Jeffers has even intimated his disapproval of the White House decision on the grounds that there is now no leeway left in the program. The least faltering anywhere will be disastrous. It can be assumed that Mr. Jeffers will start building up a little pressure on his own account to get himself out of what he considers a bad situation for the rubber program and the country as a whole.

Purchase of Critical Materials

All purchases of metals and minerals—as well as all other commodities except rubber—for import for government account will be turned over lock, stock and barrel to the Board of Economic Warfare on Feb. 25. Since April, BEW has had delegated executive authority to decide what critical materials to buy, where, and at what price. But, for the most part, deals have been worked out by Jesse Jones' men from Metals Reserve Co. and similar subsidiaries of the Reconstruction Finance Corp. After Feb. 25, Vice-President Wallace's BEW men will do all the negotiating, leaving to Jones only the job of issuing the checks.

This shift in internal operations is the latest round in the Wallace-Jones feud which was climaxed last Spring when BEW got authority to tell Jones where to spend RFC's money when it comes to foreign purchases. For a while, BEW was content to let the Jones forces do the work under BEW supervision, but in January when Rubber Czar Jeffers vested in Rubber Reserve Corp. full authority over foreign purchases of that commodity, BEW stepped in to take jurisdiction over all other purchases.

Actual effect of the maneuverings on the nation's purchases of strategics from other countries probably is nil.

The New Congress

The end of January was too early in the game to get a clear picture of the new Congress, which is being called the "Victory Congress" after the President's State of the Union address holding out the possibility of an armistice in 1944.

Biggest war jobs presented to the Congress by the President in this and his budget message are those of appropriating some \$109 billion to prosecute the war and run the Government in fiscal 1944 (July 1, 1943–June 30, 1944) and of finding ways to meet FDR's call for paying 50 percent of the war cost as we go. This means \$16 billions in taxes added to the estimated \$31 billions which existing laws would produce. Increased withholding taxes, a sales tax and probably stepped up Social Security deductions all seem to be in the cards.

There was little doubt but that the President's requests for some \$100 billions all told in war funds will be voted. But there will be acrimonious debate before many of the proposals for non-direct wartime appropriations are approved. These funds to run the Government are \$2½ million below the 1939 budget—but they are still \$2½ billion above the 1932 level.

Legislation "catching up" income taxpayers to a current, instead of a year-lag basis is earmarked for early consideration but Congressional leaders in January were moved to point out that regardless of the fate of the Ruml Plan or any substitute for it, more than 27,000,000 Americans still will owe a tax payment on March 15. Too many people were getting the idea that "forgiveness" of the 1942 tax would mean a tax vacation.

Drafting of Workers

Coming, and perhaps rather soon, is a major Washington battle for a National Service Act, including both men and women, which would allow drafting of workers for jobs on the home front as men are now drafted for military service.

Several alternative proposals will be before Congressional committees when the subject is taken up, including the bill of Senator Austin, Vermont Republican, patterned after the principles outlined by Grenville Clark, New York

attorney and personal friend of the President. McNutt is definitely in favor of a National Service Act, but other segments of the executive side of Government are just as firmly opposed. Congressional temper hasn't jelled.

While pumping for a service law, McNutt meanwhile continues to veer away from mandatory action in carrying out his broad delegated executive powers. Regional and area WMC offices are being given increasing autonomy and McNutt has formally denied any intention at this time to put all hiring under the U. S. Employment Service—he has authority to do so under WMC's charter from the President.

Production of minerals and metals many of which are raw materials for the chemical industry have been placed in the hands of a new WPB agency named the Mineral Resources Coordinating Division. Howard I. Young, president of the American Zinc, Lead and Smelting Co. of St. Louis, Mo., was named the director of the new division. Mr. Young had previously accepted appointment to the position of chief of the Minerals Bureau taking the place of J. M. Scribner who was assigned a position higher in the War Production Board organization.

Under the new arrangement the Mineral Resources Coordinating Division will be responsible for coordinating plans, programs and procedures within WPB and with the other government agencies. It will also assemble recommendations for increasing minerals supply and will advise the Program Vice Chairman in these matters.

The new position assumed by Mr. Young carries with it the chairmanship of two important committees, Minerals and Metals Advisory Committee and Mineral Resources Operating Committee. The former is made up of representatives of 11 government agencies to advise of plans and programs. The latter is a small group that will advise on procedures. Authority to act is vested in the chairman in both cases.

Dr. Reid Promoted

The chemical industry is in danger of losing close touch with Dr. Ernest Reid because of his rapid promotion. Dr. Reid was given two major promotions within the short space of eight days in January and ended up Deputy General for Industry Operations.

Dr. Reid came to Washington in June 1940 to serve on the Advisory Commission of the Council on National Defense. When the Chemical Branch was organized, he became its assistant chief and was appointed head of the Branch in February 1942. It was only last November that Dr. Reid was appointed director of the Commodities Bureau, one of the five operating Bureaus created at that time to co-ordinate the activities of related WPB industry divisions.

On January 12 when Curtis Calder became Deputy Director General for Industry Divisions, Dr. Reid was moved up to be Mr. Calder's assistant. Just a week and one day later Dr. Reid was appointed the Deputy Director General taking the place of Mr. Calder who moved up to fill the position made vacant by the resignation of Ernest Kanzler, Director General.

The reason for Dr. Reid's rapid climb can be found in the record of the Chemical Branch under his direction and since. With one exception there has been no shortage of chemicals sufficiently acute to hold up the war effort. The Chemical Branch was one of the basic organizations formed back 2 or 2½ years ago. Since that time the Branch has lost none of its men in any of the major reorganizations nor has it been stripped of any of its authority except over fats and oils, transferred to the Department of Agriculture in December when the Office of Food Administrator was set up.

Cost Figures for Chemicals

The chemical industry is showing concern over the requests that are being made by OPA for cost figures on a long list of products with the idea of setting lower prices for certain products on an industry-wide basis or possibly even for each individual operator. In either case the effort represents a terrific waste for both the manufacturer and for the government. The same ground is covered in the Renegotiation Act and in any case excess profits will be taken care of by the Collector of Internal Revenue. The practical benefits to be derived from this OPA activity are obscure.

In at least one instance OPA has set a ceiling price below the cost of production of a chemical made for direct war purposes on the theory that the manufacturing chemist could make up the loss on profits from other operations.

Nothing has been done about the establishment of the laboratory authorized by the last congress to be located in the state of Pennsylvania for the study of additional uses of anthracite. The authorization was for $450,000 for the facilities and $175,000 annually for its operation.

Some of the problems suggested for investigation are the use of anthracite in the production of water gas and producer gas. A shortage of gas has developed in Northern New York and Southern Pennsylvania adjacent to the anthracite fields. No later than the last week in January Donald Nelson issued an appeal to the residents of the area to conserve gas. There is also a possibility of using the finer sizes as a substitute for oil. Extremely finely divided low ash anthracite might be mixed with oil and used in a sort of colloidal state to increase the available heat units.

Development of new uses for anthracite would also provide additional employment in the eastern Pennsylvania coal fields for the post war period.

After April 1, it becomes illegal to accept delivery of any item of copper, aluminum or steel—the "controlled materials" under CMP—when stocks on hand exceed a 60-day supply. This is the edict of CMP Regulation No. 2, issued in mid-January.

Purpose of the inventory control regulation is to hold aluminum, copper and steel inventories to a maximum of 60 days' forward requirements. The controls are applicable item by item, with delivery permitted of one type of wire, for instance, even though inventory of another type happens to exceed the limit. An item is defined as that "which is different from all other items . . by reason of one or more of its specifications, such as length, width, thickness, temper, alloy, finish, method of manufacture, etc."

One provision of the regulation permits acceptance of deliveries in standard commercial quantities even though such delivery temporarily increases inventory beyond a 60-day limit. On the other hand, the regulation does not permit holding a full 60-day supply where a smaller amount is adequate.

Bismuth Shortage

Expanding military requirements have resulted in bismuth being put under complete allocation and inventory control. The indicated unrestricted requirements for the coming year are many times the available supply. The situation will be met as in all similar instances by a sharp curtailment of non-essential uses and then by bringing the military program into line with the supply.

Up to the present time about 50 per cent of the domestic production of bismuth has been used in the drug and the pharmaceutical field. A cut will be made here since there are substitutes with equal or superior healing qualities to the bismuth salts they will replace.

The use of bismuth in the automatic water jets of fire sprinkler systems will stop. In the place of the rose metal plug will be found a ball of glass or plastic containing a liquid which will expand and break the ball when heated beyond a certain temperature. Use of solder containing bismuth will be curtailed for both military and civilian industrial purposes. This will be brought about mainly by the substitution of mechanical connections for physical connections.

Priority Ratings Changed

Priority ratings for repair, maintenance and operating supplies have been raised again for producers of chemicals. The acknowledged purpose was to provide ratings high enough to secure material under P-89. The new ratings are an AA-2X and AA-5 the former to be applied to the purchase of materials listed in the order. The list is substantially the same as the list which appeared on the fourth quarter Pd-25A form. The AA-2X rating takes the place of the A-1-a that previously applied. The AA-5 rating may be applied to materials not on the list for which the highest rating previously available was an A-1-c. In the case of containers the order was relaxed to permit the purchase of materials for maintenance and repair of pressure cylinders.

The administrator of Order P-89 has suggested that the chemical industry familiarize itself with the provision in the order to secure higher ratings when the AA-2X and AA-5 prove inadequate.

INTERPRETING WASHINGTON

EDITOR'S NOTE: *Governmental orders, rules and regulations covered by this installment were issued during January, 1943. Should the reader desire more complete information, he is urged to write to the appropriate federal agency citing the order number or release date.*

TIN

Conservation order M-115 as amended Jan. 13 directs manufacturers to curtail the use of tin in toothpaste and shaving cream tubes. Effective immediately, the use of tin in the manufacture of shaving cream tubes is prohibited. Beginning April 1, 1943 the tin content in toothpaste tubes is to be reduced to 3 percent of the weight of the tube. During 1943 manufacturers may not pack more than 75 percent of the amount of tooth-paste they packed in 1942 in tubes containing tin. Manufacture and use of all-tin tubes used by druggists to fill authorized prescriptions by physicians, dentists and veterinarians, is prohibited, except that existing stocks may be used up. Approximately 100 tons of tin will be saved during 1943 for war material by this amendment.

BISMUTH

Effective Feb. 1, 1943, Conservation Order M-276 provides that no person may deliver, accept delivery of, or use any metallic Bismuth without specific authorization by WPB. Exceptions to delivery restrictions are deliveries to Metal Reserve Company, deliveries to other producers, to a distributor (if he does not have an excessive inventory) and deliveries to a person whose total receipts during that month total less than 50 lb. Use of Bismuth in consumer inventory is likewise controlled, and no more than 50 lb. per month may be used for such inventories without specific authorization by WPB.

METHYL ALCOHOL

Because of increased demands for military requirements methyl alcohol, or methanol, was placed under complete allocation, effective Jan. 15, with the issuance of General Preference Order M-31 as amended. There will be an apparent shortage for 1943 of about 10,000,000 gal. excluding the methanol from wood distillation, unless the use of methanol for unessential items is curtailed as rapidly as possible. The increase in the demand is caused primarily by the requirements for formaldehyde to produce hexamethylene tetramine, an ingredient in explosives used by both the United States and Great Britain. It is also caused by increasing demands for methanol to be used in the manufacture of methyl methacrylate resins for military aircraft, and by increasing demands for hexamethylene tetramine for Russia.

ALKANOLAMINES

Alkanolamines were put under direct allocation on Jan. 9, with issuance of allocation order M-275. They are defined as monethanolamine, diethanolamine, and triethanolamine. The reason for allocating alkanolamine is the need to divert certain quantities of the material from the production of unessential civilian products such as polishes and waxes to direct war use, to the refining of petroleum products and to assure quantities for use as intermediates in the manufacture of essential pharmaceuticals and medicinals. The standard PD-600 and PD-601 chemical allocation forms are to be used and should be filed on or before the 10th day of each month.

DYESTUFFS

Far reaching controls over dyes and organic pigments used in civilian clothing and other consumer products were announced on Jan. 21, by the amendment of order M-103 (Dyestuffs and Organic Pigments). The order is retroactive to Jan. 1, 1943 and provides for an average reduction of 40 percent below 1941 figures in the sale and purchase of all organic dyestuffs and organic pigments for civilian use. The sole exceptions are dyestuffs and organic pigments derived from vegetable sources, inorganic dyes, and organic dyes synthesized or produced from relatively non-critical materials. The order was made necessary by shortages of chemical materials used in extremely important phases of the war program. These materials include: benzene, aniline, toluene, phthalic anhydride, phenols, cresols, xylenols, etc. As a result of the order approximately 55,000,000 lb. of dyes and the raw materials that go into them will be made available for the war effort. In connection with this order, provisions of M-53 relating to inorganic pigments used in printing ink were put under M-103.

CARBON TETRACHLORIDE

Order M-41 amended Jan. 9, granted an extension of the WPB ruling allowing producers of carbon tetrachloride to sell their products to manufacturers who hold a B-2 rating and use the product for certain specified civilian purposes. The specified uses are (1) degreasing where the work is a non-defense nature, (2) manufacture of packaged spotting and cleaning preparations, (3) dry cleaning, and (4) manual cleaning of non-absorbent objects. Extension of the relaxation was ordered for the entire year of 1943, but no deliveries may be made on orders carrying the B-2 rating until all war and essential civilian requirements have been met.

CELLULOSE FILMS

Further restrictions in the use of cellulose films were made on Jan. 4, by the issuance of Limitation Order L-20 as amended. Increased need for cellulose film in the war effort and essential metal-replacement use have increased the demands for this material above supply, the chemicals division of WPB states. One outstanding reason for further curtailment is that the film is needed for gas capes for the Army. Another is the critical nature of some of the constituents of cellulose, particularly glycerine, nitric acid and high alpha wood pulp. With various exceptions, the use of cellophane or similar transparent material is prohibited for the packaging, sealing or manufacture of a given list of products, mostly food products. The use of cellulose film in the tobacco and baking industries is reduced by 10 percent. Cellophane and similar transparent films are allowed as a metal replacement for collapsible tubes in certain cases. Cellulose caps and bands are also allowed as a metal top replacement to serve as the primary closure for certain products. Inventories are restricted to a 45-day supply. The Chemicals Division estimates that the total savings that will be effected by the restrictions outlined above, taking into consideration the new uses allowed, should be approximately 10,000,000 lb. The main saving will be in moisture-proof film, the outstanding bottleneck in the production of cellophane to meet all demands.

ANTI-FREEZE SOLUTION

The manufacture of anti-freeze solutions, compounded with inorganic salts or petroleum distillates was prohibited by Limitation Order L-258 issued on Jan. 20. The new order was issued as a result of widespread complaints from motorists, truck operators and motor service establishments throughout the country that certain anti-freeze solutions recently distributed in large quantities in cold weather areas have been found highly destructive to radiators, ignition systems and rubber connections in automobiles and trucks. The solutions prohibited by the order include those compounded with inorganic salts such as calcium chloride, magnesium chloride, or sodium chloride, as well as petroleum distillates. It has been found that the average automobile cooling system designed for use with water cannot handle heavy oils successfully. Solutions compounded with inorganic salt, even more injurious to cooling systems and engines,

are known to have corrosive action on engine jackets, on the solder in the radiators and on aluminum which is sometimes used in manifold pumps and headers. Moreover, serious difficulty is experienced if the solution comes into contact with spark plugs or ignition wires.

CHEMICAL FERTILIZERS

Conservation Order M-231, governing the distribution of chemical fertilizers has been revoked in its entirety by the Director General for Operations. Action was taken because authority with respect to the production of food is now in the hands of the United States Department of Agriculture which recently issued a substantially similar order over the signature of the Secretary of Agriculture.

URANIUM

Delivery of Uranium and its compounds for use in ceramics was forbidden by Conservation Order M-285, issued on Jan. 26. This order expressly forbids sale and delivery and purchase and receipt of uranium and its compounds for use in glass, pottery, and other ceramic products.

OPA PRICE RULINGS

A simple method for determining manufacturers' maximum prices for thousands of new miscellaneous plastic parts and sub-assemblies used in many essential war and civilian articles is contained in order No. 229 under the General Maximum Price Regulation. A wide range of miscellaneous plastic parts is affected by the action. Some of these are parts used in the manufacture of personal and household accessories, notions, jewelry, lamps, smoker's articles, sporting goods, and the like. The action does not apply to those items which can be or have been priced under the GMPR on the basis of similar products (Section 1499.2) All cost factors, including labor and transportation, must be computed on the basis of rates prevailing during March, 1942, and raw materials costs must be based on actual costs not to exceed ceiling prices.

Revised General Order No. 27 issued and effective on Jan. 22 delegates to State Directors and District Managers of the OPA authority to issue license warning notices to licensed sellers who, in their judgment, have violated price regulations. If a seller commits another violation after receipt of the warning notice, OPA may go into court and ask that his license be suspended for a period of not more than one year.

On Jan. 18 OPA exempted dehydrogenation catalysts and catalyst carriers from price control when sold for use in the production of synthetic rubber. The action was contained in Amendment No. 50 to Supplementary Regulation No. 1, effective Jan. 23, and will permit complete price flexibility during the formative stages of the synthetic rubber industry and its sub-industries.

NEW PRODUCTS AND MATERIALS

ORGANIC ALKYL PEROXIDE

One of the more recently developed chemicals is an organic alkyl peroxide. The Union Bay State Co., Cambridge, Mass., recently announced the availability of commercial *t*-butyl hydroperoxide, a formulation of *t*-butyl hydroperoxide, an unusually stable liquid with an active oxygen content of 17.8 percent (at 100 percent concentration) which can be handled and shipped in large quantities without danger of explosion from shock, is soluble in many common organic solvents such as alcohol, ether, ketones in general, esters, aromatics and petroleums, is slightly soluble in water, and is comparatively stable in the presence of various alkalis and acids. Standardized at a concentration of 50-60 percent (10± percent available oxygen), commercial *t*-bufyl hydroperoxide appears to be ideally adapted for use as a catalytic agent in one or two phase polymizerations, as an oxidation agent for laboratory purposes, as a drying accelerator in oils, paints, varnishes, etc., as a combustion accelerator in heavy fuel oils used in diesel engines, as a bleaching agent for cotton, wool and other fabrics, and for numerous other uses.

INJECTION MOLDING OF THERMOSETTING MATERIALS

The injection molding of thermosetting materials in continuous production has long been a fond dream if not a forlorn hope of the plastics processing industry. Now that this has materialized and the hope is a reality as demonstrated by the developments and current activities of United Plastics Corp., Cleveland, Ohio, through their use of what is termed "jet molding" the new process offers a number of advantages to users of plastics such as electrical, automotive and aeronautical industries, whose requirements call for parts of exceptional density and high uniform quality to be made available on fast production schedules.

Principal advantages of this injection molding process are as follows:

1. Low cost molds, fewer cavities for comparable production rates, marked saving in metal and manhours of skilled labor.
2. Shortened preparatory interval before starting continuous production.
3. Fast production rates.
4. Ready accommodation of various types of material without changes in the molds.
5. High uniformity of product.
6. Minimum rejects on work involving close tolerances.
7. Special facility in molding parts with inserts.

The basic difference between this and other processes is that all the heat load necessary for polymerization is introduced into the material prior to injection. The mold merely shapes and sets the material.

WORTHLESS TAILINGS NOW VALUABLE TUNGSTEN AND TIN

A new process operating with success is enabling the Foote Mineral Co., Philadelphia, to recapture from the tailings and complex tinny wolfram ores hauled 7,000 miles from the mines in Bolivia great amounts of tungsten ore that has a quality quite comparable with the best ores produced in China and Burma. The same process produces a tin ore which also is virtually free of impurities and is accepted readily by smelters as about the best that can be obtained. Both ores are recovered from residue which used to be ignored as worthless because of the lack of a practical method of separating the two metals.

SPEED OF PAPER MANUFACTURE INCREASED

The speed of paper manufacture is increased as much as 10 percent by the new use of a duPont chemical which greatly retards the formation of slime in mill machinery. Moreover, a few ounces added to groundwood pulp stored for making newsprint prevents deterioration due to mold and bacteria for over a year, although 30 days is usually sufficient during warm weather to cause spoilage. With this chemical, called Lignasan, mills have been known to go six weeks without halting for a cleanup. Slime is created by microscopic organisms entering mills in the vast volume of water used in paper manufacture. This mold-destroying chemical has been used for several years to prevent the objectionable blue stain in freshly sawed lumber, but it has come into use only recently for preventing slime developed in pulp and paper mills. Significance of the new development lies chiefly in the preservation of pulp and the releasing of vital cellulose for other purposes. The announcement made clear that while more efficient slime control saves considerable non-productive labor, it probably will not result in more newsprint being available, since pulp supplies are strictly allocated.

EMULSIFIERS, DETERGENTS AND WETTING AGENTS

These versatile surface active agents, Atlas Spans and Tweens, are being supplied now in sufficient quantity to meet the unusual demands of the present, and are available in experimental lots for use in the new combinations of oils and water that are being worked out for the future, according to the Industrial Chemicals Department, Atlas Powder Co., Wilmington, Del. These new materials are emulsifiers, detergents and wetting agents. Chemically the Spans and Tweens are two related series of long chain fatty acid partial esters and polyoxyalkylene hexitol anhydride esters. They possess a multiplicity of functional groups, which permits an almost unlimited number of modifications and combinations to meet special conditions. They include emulsifiers for water-in-oil and oil-in-water emulsions of either the temporary or permanently stable types. They range in solubility from completely water soluble to completely oil soluble. They are non-electrolytes and are supplied in concentrations of 97 to 100 percent. They are virtually free of soap and inorganic salts.

HEAVY DUTY SOLUBLE OIL

Development of a heavy duty soluble oil which will help speed war production and reduce costs by providing with one oil the finish, tool life and cooling that formerly required more than one is announced by Standard Oil Co. of Indiana, Chicago, Ill. War plants have many jobs which normally require a cutting oil to give high finish and long tool life, but for one reason or another demand also the maximum cooling usually obtainable only with a water emulsion type coolant, the company explained. As a result of Standard's work such war specifications can now be met with the one heavy duty soluble oil.

The new product contains an effective amount of special compounding other than that required to give good emulsion characteristics, according to the company. It is stable in storage, mixes easily, does not gum machines or work, possesses good anti-rust properties, is non-injurious to workmen's hands and is not susceptible to odor development. In addition it has no harmful effect on machine lubrication where used as recommended by the manufacturer's cutting oil engineers.

WOOD PULP FOR SMOKELESS POWDER

The adaptation of wood pulp for powder manufacture has increased output about one quarter wherever it has been used. Development of the new powder process was credited to Ralph L. Stern, chemical superintendent at the Parlin, N. J., plant of Hercules Powder Co., whose experimental work on wood cellulose made possible the use of wood pulp for rifle and cannon powders. Previous attempts to use wood pulp had resulted in powder of uncertain quality and the process was slow and expensive. The Weyerhaeuser Timber Co., Longview, Wash., and Rayonier, Inc., San Francisco, Calif. cooperated in the experimental work, supplying wood pulp

in the form and according to the specifications required for the smokeless powder work. The pulp and paper companies developed a standard grade of wood pulp in a special size suitable for the experimental work. Through this cooperation the wood pulp requirements of the United Nations' explosives industries are now such that they can be met easily by wood pulp producers in all the Nations. The company estimated that Hercules wood pulp development, based upon the difference in the cost of the cotton and wood pulp, would lower the cost of manufacture of smokeless powder at United States ordnance plants about $20,000,000 in 1943.

RUBBER-LIKE PLASTIC

An excellent process for using a specially plasticized Saflex resin to replace rubber in coated fabrics has been developed by Monsanto Chemical Co., and is now being extensively used in fabrics for army raincoats, hospital sheeting, gas protective fabric, air mattresses, water bags and many similar items. Saflex, originally applied to the safety glass sheets of vinyl resin has been extended to cover all the varicus vinyl acetal formulations supplied by Monsanto. By this process the Saflex coating is transformed from a thermoplastic to a thermosetting material which readily meets most of the tests applied to rubber, oil and pyroxylin coatings and in many cases outstrips the materials around which the tests were written. It is supplied to the fabric coating field in sheets for calendering or as a prepared dope for spreading. One of its chief advantages is that it can be vulcanized and otherwise lends itself to these two conventional rubberizing methods more readily than any other synthetic rubber or resin. In fact, the entire processing and curing of this material is so like that of rubber that no changes from the usual procedure are necessary, no new equipment or mechanical adjustments are needed and no additional training is required for labor. The Saflex molding compounds can be supplied in either thermoplastic or thermosetting form. The thermoplastic materials are suited to injection or compression molding or to extrusion, the thermosetting materials can be easily molded by compression. Objects molded of either type can be given rubber-like qualities and some development work is now in progress on military and essential industrial applications.

NEOHEXANE

The president of the Standard Oil Co. of Indiana has announced a "new and excellent" process for the manufacture of neohexane has been developed in Standard's laboratories. Details of the process will not be made public owing to government secrecy restrictions applicable in wartime. With the approval of appropriate authorities, however, essential information concerning it is available to companies now manufacturing or contemplating the manufacture of 100-octane gasoline.

FROM THE LOG OF EXPERIENCE

Dan Gutleben, Engineer

TRAVELING from Saginaw to Bay City is now comfortably accomplished by bus or taxi. The taxi makes it in about a half hour, while the "fast express" on the Pere Marquette requires an hour. Along the super highway there stands the melancholy shell of a concrete mansion minus doors and windows. The builder of this monument was the superintendent of the road construction job. He did not have the opportunity to finish the house and in fact has no need for it now as he has been given a long-term lease on quarters in the penitentiary. While the road construction was in progress he diverted men and materials for the extra-curricular activity of building the house and he neglected accounting formalities.

WHEN DOC EMIGRATED to Canada to an "ethical" alcohol distillery in Hamilton, Ontario, his command of English was meager, though he was well versed in the fundamentals of his job. He sought to acquire the English idioms by reading books on his specialty in English where his understanding of the context would supplement the lexicon. Accordingly, he presented himself at the city library with a request for books on alcohol distillation. The librarian was a prim and precise maiden lady wearing the Eifel Tower hair-do that had been popular fifteen years earlier. She registered pain and expressed distress that one so young should be interested in so nefarious a traffic. Fortunately, Doc did not grasp the import of her harangue or she might have dissuaded him from the path that has since led to success. Finally in desperation she brought him a very large volume of periodical excerpts dealing with the evils of alcohol and the movement to abolish its use for beverage purposes.

A RIGGER would often request Charlie Robbins, former structural engineer of the Forrest City Iron Works, to advise if a certain beam could support the load he was about to suspend from it. Charlie had a rule for this. It is easy to remember the weight of standard beams, but the section modulus requires the presence of a handbook. Charlie found that the uniformly distributed burden that a beam can support is the product of the depth by the weight divided by the span. Thus a 15"x42 pound I-Beam on a 21-foot span has a load carrying capacity of 30,000 pounds. This is on the basis of 16,000 pounds tensile strength. If anyone desires to check the accuracy of this short-cut let him try it with any Am. Std. beam and then compare results with the handbook prepared by the aid of highly involved mathematics.

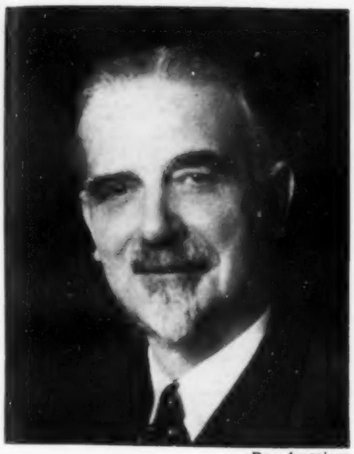
Charlie possessed a most sympathetic nature. He once related a distressful story about the ill fortune of a waitress at his favorite inn. This young woman confided the sad facts to him at breakfast. Soft-hearted Charlie soothed with cash. The effect of the story was even visited on the Chronicler but only by lend-lease to tide Charlie over the week end.

FORTY YEARS AGO the boys built a 36 inch sewer starting under the pan house and continuing thence under the melter house and raw sugar warehouse. The drawing showed cast iron, but the pipe was made of $\frac{5}{16}$ inch steel plate. The last 200 feet ahead of the discharge at the Delaware River, is located 8 feet below the floor of the raw sugar bin where we store raw sugar in bulk to a depth of 38 feet. Recently the bottom rusted out of the pipe and the sewage has been flowing on a bed of soil, which is a mixture of gravel, cinders and sundry building debris. All of this is perfectly satisfactory except that now and then during the past ten years we have had geysers spurting up through the basement floor under the pan and melter houses where the sewer is nearer the surface. When these signs of distress occurred, we dug up sections of the sewer and repaired it by wrapping steel sheets around and then covering with reinforced concrete. This provided an occasional uncomfortable Sunday's work but otherwise caused no gray hairs. However, once when the big bin happened to be empty we observed a depression in the floor. Forthwith we dug up a space and found that some soil had been eroded. Visions of the failure of the sewer and 38 ft. of sugar caving in and washing into the river were disturbing. We couldn't work in the bin because of the need for sugar storage, so we are now building a new 36-inch sewer outside of the warehouse. This sewer is going to last forever! It is made of vitrified clay $2\frac{3}{4}$" thick, encased in 1:1½:3 reinforced concrete a foot thick. We had to dig 13 feet into the bottom and keep the pumps going. At the end we had to bore a 38-inch hole through a concrete seawall 7 ft. thick.

IT IS A SIN to build a sewer under a building without using strong and enduring materials. I committed such a sin once in Utah and if I live as long as Methusala I'll never do it again. On that job we had a 24" crock sewer running from the washer pit to the ditch a thousand feet distant and this sewer ran right under the pulp silo. The silo has a concrete floor but the soil in which the sewer was laid was sandy. At the end of the campaign—with only one day to go—the sewer collapsed and plugged! A blizzard was raging without and the thermometer registered 10 below. I had left the job for the comforts of California. Fred Jira dug an old 6" pump out of the scrap pile and thereby lifted the water into the gutter of the roadway in front of the works. The day's cutting of beets was extended to a week. Fred had spent some years in Fiji and in California. While he was supervising the job of chopping ice out of the ditch he was draped with a heavy ulster that reached to his shoe tops. To supplement the heat from his God-given heating system, he placed a lighted lantern between his feet.

The moral of course points to the unwisdom of building a sewer of shoddy construction in the wrong place but it is to be noted that Providence took cognizance of the general average of behavior and delayed punishment till there was only a day's operation left!

PERSONALITIES



Pan-American

Wallace P. Cohoe

Norman C. Hobson

✦ WALLACE P. COHOE, consulting chemist of New York, has accepted nomination for the presidency of the Society of Chemical Industry with headquarters at London, England. Dr. Cohoe has been a vice president since 1940.

✦ GLENN L. HASKELL has been elected by the board of directors to the presidency of the United States Industrial Alcohol Co. He has served for some time as executive vice president. The directors elected Charles S. Munson chairman of the executive committee.

✦ H. EMERSON THOMAS, consultant, was elected president of the Compressed Gas Manufacturers' Association at the recent annual meeting. Thomas Coyle of E. I. du Pont de Nemours & Co. was elected first vice president and Robert J. Quinn of Mathieson Alkali Works was elected second vice president.

✦ ERNEST W. REID has been appointed as deputy director general for Industry Divisions of WPB. He succeeds Curtis E. Calder, who was named director general for operations. Dr. Reid, who has served WPB and its predecessors in many capacities, was Mr. Calder's assistant. He came to Washington in June 1940.

✦ ROGER C. GRIFFIN of Needham, Mass., son of Roger B. Griffin who with Arthur D. Little founded the organization of that name in 1886, has been elected vice president.

✦ HARRY E. NEWELL, assistant chief engineer of the National Board of Fire Underwriters, was awarded the James Turner Morehead medal for 1941 for his leadership in developing standards for installation and operation of acetylene equipment and systems. The medal was presented by Henry Booth, past president of the Association.

✦ NORMAN C. HOBSON has been appointed manager of the Salt Division of Canadian Industries Ltd. He replaces C. M. McDaniel who has returned to his former associations in San Francisco.

✦ CECIL E. JOHNSON is now with the Dicalite Co. in the capacity of sales engineer. Mr. Johnson graduated from Columbia University with a degree in chemical engineering and has spent the last ten years in research and development. He comes from four years' work as director of research, Engineering Division, Reddir, Inc., New York, N. Y.

✦ O. A. NELSON, former research chemist with the United States Department of Agriculture, has been appointed to the technical staff of Battelle Memorial Institute, Columbus, Ohio. Dr. Nelson, a graduate of North Dakota Agricultural College, holds a master's degree from Princeton University and a doctor of philosophy degree from the University of Maryland. Prior to joining the Battelle staff, he was associated with the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture.

✦ NELSON C. WHITE is magnesium chloride superintendent of the Texas plant of International Minerals & Chemical Corp. Mr. White was educated in the chemical engineering department of Rhode Island State College, and joined International from a position as Production Manager of Fields Point Mfg. Corp. of Providence, with whom he had been associated for 15 years.

✦ C. K. TURNER is electrolytic superintendent of the Texas plant of International Minerals & Chemical Corp. Previously Mr. Turner had been associated with the American Steel & Wire Co. at Cuyahoga, Ohio, where he had developed processes and equipment for electroplating continuous steel strip and other electrolytic processes. He had had a highly specialized experience in addition to his training at the Electrochemical School of Pennsylvania State College and at Case School of Applied Science.

✦ A. E. RUEHLE is chief chemist for the Texas magnesium plant of the International Minerals & Chemical Corp. Mr. Ruehle had been a research chemist on the staff of the Bell Telephone Laboratories, New York, N. Y., for more than ten years. He was educated at the University of Idaho, Columbia and Massachusetts Institute of Technology.

✦ E. E. WREGE, a specialist in electrochemistry, has joined the International Minerals & Chemical Corp. at its Texas plant. Mr. Wrege studied mechanical engineering at Stevens Institute of Technology, and after two years with General Chemical Co. as a chemical production engineer, taught chemistry at Hofstra College in New York for three years. He has recently completed several years of advanced chemical engineering work at Columbia University.

✦ PAUL D. MERCIA, vice president International Nickel Co., has been elected an honorary member of the American Institute of Mining and Metallurgical Engineers. The award was made for his outstanding leadership in physical metallurgy, for his contributions to the improvement of ferrous and nonferrous alloys, both through invention and practical development, and for his distinguished and devoted services to the Institute.

✦ THEODORE MARVIN, advertising manager of Hercules Powder Co., Wilmington, Del., has been awarded the "Man of the Year" award for his advertising to the process industries by *Industrial Advertising*.

✦ JONAS R. MOORE, a graduate of the University of Nevada, has been appointed to the research staff of the Battelle Memorial Institute, Columbus, Ohio, and has been assigned to its division of chemical research. A former associate of the General Chemical Co., El Segundo, Calif., and of the General Chemical Defense Corp., Point Pleasant, W. Va., Mr. Moore holds a bachelor of science degree from the University of Nevada, and has had post-graduate work at the University of Southern California.

✦ HOWARD COONLEY of New York has been appointed director of a new Conservation Division of WPB. Mr. Coonley, formerly board chairman of the Walworth Co. and a past president of the National Association of Manufacturers has been a deputy director of the Con

servation Division, which has now been divided into two divisions. The new Conservation Division will consist of the three technical branches included in the former Division.

♦R. S. McBride who represents *Chem. & Met.* in Washington will serve on the Research and Advisory Committee of Agricultural Research Administration.

James D. Lynch

♦James D. Lynch, a second lieutenant of the U. S. Army Corps of Engineers, is a prisoner of the Japanese in the Philippines. Lieutenant Lynch was with Monsanto Chemical Co. in St. Louis prior to being called to active duty in the summer of 1941. He was with the American Forces on Bataan Peninsula where he was in command of a demolition platoon of Philippine scouts. Whether he had reached Corregidor is not certain, but he was known to have been located on Bataan and it is assumed that he was taken prisoner there. Lieutenant Lynch was a chemical engineering graduate of Clarkson College of Technology, Potsdam, N. Y.

♦Walter J. Baeza, president of the Industrial Research Co., New York, is one of eight New York state chemists, educators and Civilian Defense officials who were graduated January 15 from the advanced gas specialists school sponsored by the office of Civilian Defense at Amherst College.

♦C. C. Furnas, on February 1, became director of research for Curtiss-Wright Corporation, Buffalo, N. Y.

♦S. Caplan, who for the past nine years has been associated as research chemist with the Harvel Research Corp., has become the research manager and acting technical director of the Irvington Varnish and Insulator Co., Irvington, N. J. Mr. Caplan succeeds C. F. Hanson who has been appointed chief consulting engineer and will be responsible for expediting technical work on war production.

♦Lawrence A. Appley, vice president of Vick Chemical Co. has been appointed executive director of the War Manpower Commission, according to the announce-

ment of Chairman Paul V. McNutt. Under the recently announced reorganization of the Commission, the executive director holds complete administrative authority over all phases of the staff services, planning and operations. Mr. Appley has been with the Commission since December 30 when he was appointed director of the Bureau of Placement.

✦ H. B. Viedt, for many years manager of the Best Foods plant in San Francisco, has been elected vice president in charge of production of The Best Foods, Inc., following the acquisition of the former Best Foods organization by the Hecker Products Corp. and the change in name of the latter to The Best Foods, Inc. He will have charge of plants and mills manufacturing flour and other foods, and shoe polish in Bayonne, N. J., Buffalo, N. Y., Chicago, Indianapolis, Minneapolis, Kansas City, Dallas, San Francisco and Canada. Associated with him will be T. A. Marshall, in charge of the margarine and mayonnaise plants; V. B. McLean, manager of the cereal plants and J. T. Heckel, manager of the shoe polish plants.

Walter J. Murphy

✦ Walter J. Murphy, who has been editor of *Chemical Industries* for several years, has accepted the appointment as editor of *Industrial and Engineering Chemistry*. Mr. Murphy joined *Chemical Industries* in 1930. He is a graduate of the chemistry department of Polytechnic Institute of Brooklyn.

✦ R. Henry Morris is now connected as a principal industrial analyst with the Eastern Regional Research Laboratory at Philadelphia of the United States Department of Agriculture.

✦ Ernest W. Reid, who has been chief of the Commodities Bureau will be assistant to Curtis Calder, deputy director general for Industrial Division, W.P.B. Dr. Reid was a senior industrial fellow in Mellon Institute, Pittsburgh, before going to Washington in June, 1940, as a member of the Advisory Commission to the Council of National Defense. Later he was made assistant chief of the Chemicals Section and in February, 1942, was appointed chief of the Chemicals Branch of W.P.B.

Robert L. Taylor

✦Robert L. Taylor, who has been in the advertising department of Monsanto Chemical Co., St. Louis, has been appointed editor of *Chemical Industries.* Mr. Taylor upon graduating from the University of Michigan in 1936 joined the editorial staff of *Chem. & Met.* as assistant editor. Two years later he left to join the public relations department of Monsanto.

✦L. Zahnstecher is leaving the Blaw-Knox Division of the company by that name for services in the Naval Reserves.

✦Hugh Hughes, who has been deputy director of the Commodities Bureau, WPB, has succeeded F. H. Cabot as director. Mr. Hughes, a resident of Bloomfield, N. J., joined WPB in August 1942, as chief of the Aromatics and Intermediates Section of the Chemicals Division, was named deputy director of the Commodities Bureau in November. He was with the Carbide and Carbon Chemicals Corp.

✦William L. Spalding has moved from the New York office of American Cyanamid & Chemical Corp. to take charge of operations in the defense plant now being built in Texas, and the plants of the Arizona Chemical Co. at Brownfield and O'Donnell, Texas.

✦John S. Morris has been appointed methods engineer for By-Products Steel Corporation, Coatesville, Pa., according to an announcement by R. W. Moffett, president of the concern which is a subsidiary of Lukens Steel Co. In his new position Mr. Morris will carry on special development work in connection with improved methods.

✦James H. Fritz, formerly with National Oil Products Co., is an officer in the Chemical Warfare Service stationed at Edgewood Arsenal.

✦William R. Maull of the Mead Corp. is a lieutenant colonel in the Chemical Warfare Service. He is located at Edgewood Arsenal.

✦Harry Fletcher has been awarded the TAPPI Medal for 1942. Mr. Fletcher is president of the Fletcher Paper Co., Alpena, Mich. He graduated in chemical engineering from the University of Michigan in 1907. On leaving college he joined

the Fletcher Paper Co. of which he is now the head.

✦ Hutton W. Theller has been granted a research fellowship in cellulose chemistry by the Sylvania Industrial Corp., Fredericksburg, Va. Mr. Theller is a graduate of University of California and at present is a candidate for a Ph. D. degree in the department of Pulp and Paper Manufacture, New York State College of Forestry at Syracuse University. He will continue his research at this institution under the Sylvania Fellowship.

F. B. Lounsberry

✦ F. B. Lounsberry, who became vice president in charge of manufacturing for all plants of Allegheny Ludlum Steel Corp. in 1942, will make his headquarters at Brackenridge, Pa. Graduating with a degree in chemical engineering from the University of Michigan in 1912, Mr. Lounsberry has been with the steel industry continually since that time.

✦ W. A. Cleneay, who has been working with the engineering staff of Monsanto Chemical Co. of Texas, has been transferred to St. Louis to head the coordination of the company's activities relative to camouflage, blackouts and air raids.

✦ Ogden Fitz Simons, who has recently joined Monsanto Chemical Co., has been assigned to the Process Engineering Division of the General Engineering Department. Initially he will be at the Central Research laboratories in Dayton to assist with the chemical engineering phases of a new process now being developed under the direction of Miles Maxim, temporarily assigned to the engineering department for this project.

✦ W. S. Thornhill has been transferred from the laboratories of Shell Development Co. at Emeryville, Calif., to the New York City Office where he will be engaged in market development work.

✦ George D. Beal, assistant director of Mellon Institute, Pittsburgh, has had conferred upon him by the New Jersey College of Pharmacy in Newark, Rutgers

University, the honorary degree of Doctor of Science. In the words of President Robert C. Clothier of Rutgers, the action was taken to pay appropriate tribute to Dr. Beal for his contributions to scientific progress in general and to pharmaceutical chemistry in particular.

♦F. S. Dubbs of American Cyanamid & Chemical Co. was nominated for president of the Chemical Club of Philadelphia. The other new officers include Charles A. Wagner, of C. A. Wagner Co., vice president; W. R. E. Andrews, of W. R. E. Andrews Co., treasurer, and G. B. Heckel, Jr., *Paint Industry*, secretary.

♦Raymond M. Dennis has been appointed assistant to the president of By-Products Steel Corp., Coatesville, Pa. In his new position Mr. Dennis will have charge of the staff and general administrative work for the corporation, which is a subsidiary of Lukens Steel Co.

♦Frederick J. Dunkerley, a graduate of Thiel College and the Carnegie Institute of Technology, has been appointed to the research staff of Battelle Memorial Institute, Columbus, Ohio, where he has been assigned to war research in metallurgy. A physical chemist, he recently received his doctor of science degree from Carnegie Institute of Technology.

♦Karl F. Smith is now associated with Battelle Memorial Institute on its research staff.

♦E. W. Husemann has been appointed metallurgist in the Copperweld Steel Co.'s metallurgical department in Warren, Ohio. He was formerly with Republic Steel Co. at Chicago.

OBITUARIES

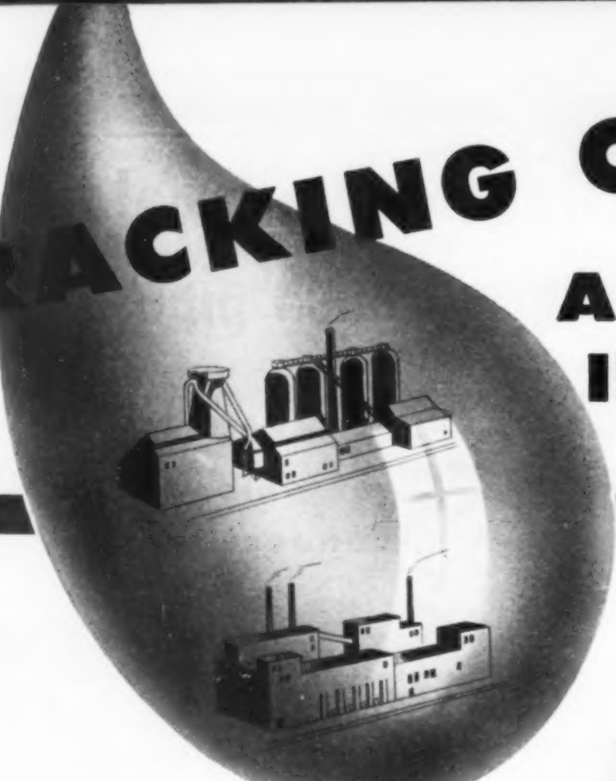
♦Ernest B. Prentice died at his home at Aquadale, near Massillon, Ohio, on January 5, from a heart attack. He was 63 years old. Born in Sandusky, Ohio, he moved to Massillon 42 years ago and was associated with the Massillon Stone and Fire Brick Co. which later became Corundite Refractories, Inc. With the late William G. Hipp and others, in 1919, he assisted in the founding of the Massillon Refractories Co. and served as its vice president and secretary until the time of his death.

♦William H. Dopp, Sr., a retired chemical engineer, of La Grange, Ill., died on December 30, aged 89 years.

♦George Washington Carver died January 5 in his home at Tuskegee Institute, Tuskegee, Ala. His age was 78. Dr. Carver was recognized as one of the outstanding scientists in the field of agricultural research. He discovered scores of uses for such lowly products as sweet potatoes, peanuts and clay.

♦W. Lee Lewis died January 20 in his home at Evanston, Ill. He had been ill for several months, but death was due primarily to injuries suffered a few days earlier in a fall. He was 64 years old at the time.

CRACKING OPEN A NEW FRONTIER IN AN OIL DROP



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brings to new refining problems the broadest experience with automatic control of chemical processes

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Bristol engineers have, over the years, gained wide experience in applying automatic control instruments to chemical processes. Today, Bristol Instruments are widely used in many of the most progressive plants in the country.

Many chemical plants, that have worked with Bristol engineers on processes involving time, temperature, liquid level, pressure, vacuum, pH value, humidity and flow, are now saving precious raw materials and manpower by insuring that process equipment will operate on the exact production schedule planned for best results. In certain cases, Bristol's Coordinated Process Control has been applied to critical factors never before controlled, or has automatically controlled entire processes with mathematical precision.

At the same time, Bristol's specific advances in individual instruments have often added new control refinements to existing systems.

If you anticipate placing a new product into production, or are experiencing control difficulties in present operations, a note on your letterhead will bring a Bristol engineer to consult with you without cost or obligation.

BRISTOL *Engineers Process*

AUTOMATIC CONTROLLING AND RECORDING INSTRUMENTS

MEETINGS AND CONVENTIONS

Electrochemical Society Makes Plans for April Meeting

ELECTROCHEMICAL SOCIETY TO HOLD APRIL MEETING IN PITTSBURGH

THE 83RD MEETING of the Electrochemical Society will be held in Pittsburgh, April 7-10, with headquarters at the Hotel Roosevelt. The tentative program of technical sessions will include those on corrosion, dielectrics, electrothermics, and automatic control.

An outstanding feature of the convention will be the symposium on dielectrics. So many new plastics, glasses and other ceramic products have been put on the market in recent years that it is difficult for the electrochemist and engineer to evaluate these new products as to insulating qualities and dielectric properties in general. F. M. Clark, chairman of the symposium, has arranged the program, and papers will be presented by foremost experts in the field. Among the companies and institutions represented are the General Electric Co., the Westinghouse Research Laboratories, Massachusetts Institute of Technology, and Commonwealth Edison Co. This symposium is scheduled for Friday, April 9.

T.A.P.P.I. HOLDS CONVENTION IN NEW YORK

THE TECHNICAL Association of the Pulp and Paper Industry will hold a four-day convention at the Commodore Hotel in New York, Feb. 15-18. More than 1,000 managers, operating men and technologists in the paper and container industries will attend to discuss wartime technical problems. Featured in the discussion will be the progress being made toward relieving the critical materials shortages by the development of new packaging materials and containers. These developments will be dramatized by an exhibit of hundreds of these new products made from paper and paperboard.

SOUTHERN SAFETY CONFERENCE TO MEET IN MEMPHIS

THE FIFTH ANNUAL Southern Safety Conference will be held at the Hotel Peabody in Memphis, Tenn., March 1-2, it has just been announced. There will be two general sessions, two public safety sessions, and two industrial safety sessions with an all-conference luncheon.

Formal opening of the conference will be given by Pyke Johnson, president of the Automotive Safety Foundation, Washington, D. C. N. H. Dearborn, executive vice-president and managing director, National Safety Council, will give a talk on "Wartime Safety." Other papers will deal with safety and health problems of the woman war worker, management's responsibility for safety, wartime traffic problems and their control, training war workers for production and safety, three dimensional painting for safety, and a panel discussion on conservation of manpower for war industries.

"FRONTIERS IN CHEMISTRY" TO BE OFFERED BY WESTERN RESERVE

WESTERN RESERVE University in Cleveland will present twelve of America's distinguished scientists in a series of lectures beginning Feb. 19 and to be held on successive Fridays through May 21. Admission will be by ticket, but tickets will not be sold for individual lectures. Tuition will be charged at the rate of $10 for each part.

The first part of the series will deal with advances in nuclear chemistry and theoretical organic chemistry, while the second part will concentrate on major instruments of science and their application to chemistry. The first lecture was given on Feb. 9 by H. C. Urey on "Isotopes, Recent Progress and Application in Chemistry and Medicine." The next lecture will be by Dr. H. S. Taylor, Feb. 26, dealing with "Application of Isotopes in Catalytic Investigations."

Other lecturers will include H. R. Crane, associate professor of physics, University of Michigan; G. E. Kimball, assistant professor of chemistry, Columbia University; Leslie G. F. Brooker, of the chemical research staff of Eastman Kodak Co.; W. H. Rodebush, professor of chemistry, University of Illinois; L. H. Germer, physicist, Bell Telephone Laboratories; L. Marton, associate professor and head of the Division of Electron Optics, Stanford University; M. L. Huggins, research chemist with the Eastman Kodak Co., and others.

STINE TO ADDRESS A.I.Ch.E.—J.C.E. MEETING IN NEW YORK

THE NEXT MEETING of the New York Section of the American Institute of Chemical Engineers will be held jointly on February 24 with the Junior Chemical Engineers of New York, the latter being in charge of the program. The principal speaker will be Dr. Charles M. A. Stine, vice president in charge of research, E. I. du Pont de Nemours & Co., who will be introduced by Dr. W. S. Landis, executive vice president of American Cyanamid Co. Dr. Stine will talk on the subject of the training and responsibilities of administration in the chemical industry.

James L. Bennett, manager of Chemical Operations, Explosives Department, Hercules Powder Co., Wilmington, Del., will give a short talk to the group in his capacity as newly-elected president of the A.I. Ch.E.

A dinner, to be served at 7:00 p.m. will precede the meeting, which will be held at the Building Trades Employers Assoc. Bldg., 2 Park Ave., (32nd St.). In order to facilitate the seating arrangement, those who plan to attend this dinner should notify Edward

CALENDAR

FEB. 14-18	American Institute of Mining and Metallurgical Engineers, 157 annual meeting, New York, N. Y.
FEB. 15-18	Technical Association of the Pulp and Paper Industry, Commodore Hotel, New York, N. Y.
APRIL 7-10	The Electrochemical Society, 83rd meeting, Hotel Roosevelt, Pittsburgh, Penna.
APRIL 12-16	American Chemical Society, 105th meeting, Statler and Book-Cadillac Hotels, Detroit, Mich.
MAY 10-11	American Institute of Chemical Engineers, 35th semi-annual meeting, Waldorf-Astoria Hotel, New York, N. Y.

T. Maples, 333 E. 53rd St., New York or telephone him at Rector 2-6900 (Ext. 159). Price of the dinner will be $1.50 per person.

AMERICAN CHEMICAL SOCIETY TO MEET IN APRIL

A FIVE-DAY WAR meeting, sponsored by the American Chemical Society, will be held in Detroit, April 12-16, it has been announced by Dr. Per K. Frolich, president of the society. The program, including technical sessions, conferences and group discussions, will be devoted entirely to advances made by chemical science and industry in relation to the war effort. Seeking to limit housing accommodations to members of the chemical and chemical engineering profession, the society's board of directors has banned trips to industrial plants as well as social events.

Fifteen of the society's professional divisions will meet. There will be a discussion on substitutes for agricultural and food commodities. Stabilization of fats, a matter of importance in food for the armed forces, will be considered in a symposium on the chemistry of fats. Other sessions will be devoted to high-protein foods and solvents in war industries. Five sessions will be sponsored by the Division of Industrial and Engineering Chemistry, of which Prof. R. Norris Shreve of Purdue University is chairman. The Division of Rubber Chemistry, of Wire & Cable Co. is chairman, will hold four sessions.

Headquarters will be at the Statler and Book-Cadillac Hotels. Scientific sessions will be held at the Masonic Temple, where registration will open Sunday afternoon, April 11. William T. Putnam, founder and president of the Detroit Testing Laboratories, has been named honorary chairman of the meeting.

SELECTIONS FROM CONVENTION PAPERS

TIN PLATING FROM THE POTASSIUM STANNATE BATH

BECAUSE OF the present acute shortage of tin, interest in electrolytic tinning to replace hot-dipping has sharply increased, since by the electrolytic method an acceptable coating for many applications can be obtained which uses only about one-third as much tin per base-box. Most of the larger producers of tin plate have plants or installations for continuous electrotinning of strip.

Electrolytes at present in use for this purpose are of two general types: the acid (stannous salt plus free acid and addition agent), and the alkaline bath (sodium stannate plus sodium hydroxide). In spite of the rather obvious advantage of plating from the stannous rather than from the stannic conditions, the stannate alkaline bath continues to be used partly because of the good quality of the plate and partly because the bath requires no special type of corrosion-resistant equipment. It is also a good detergent, thus simplifying cleaning problems.

The most serious limitation of the sodium stannate bath is that current densities compatible with reasonable cathode efficiencies are rather low: 25 amp. per sq.ft. is the usually recommended value, and 60 amp. per sq.ft. is about the maximum generally used. Many alkali bath compositions have been investigated without appreciably widening the useful current density range of the bath.

Range of composition available in the sodium stannate-hydroxite system is not in any case very wide, due to the limited solubility of sodium stannate, particularly as the caustic concentration is increased. Moreover, while other considerations would indicate the highest possible operating temperatures, the reverse temperature-solubility curve of sodium stannate still further limits the useful range.

In an effort to retain the advantages of the alkaline bath while extending its useful range of current densities and concentrations, the authors have investigated the properties of the potassium stannate plus potassium hydroxide system. While it might be anticipated that potassium stannate would exhibit behavior equivalent to that of the sodium salt, it has been found that the properties of the potassium system are quite different and in many respects far superior as regard electropating.

When potassium is substituted for sodium in equivalent quantities in a stannate plating bath, the following effects are observed: the conductivity is increased about 25 percent; the cathode efficiency is notably raised; the anode efficiencies show slight but irregular effects. Where baths of relatively high free alkali content are concerned, the higher solubility of potassium stannate permits these baths to be operated at temperatures unobtainable with the corresponding sodium salt, with all the advantages of higher conductivity and anode and cathode efficiencies.

Increasing the free alkali content raises the conductivity markedly and in general decreases the cathode efficiency but raises the anode efficiency

and the critical anode current density. Increasing the tin content of the potassium stannate bath very slightly decreases the conductivity, raises the cathode efficiency, and influences the anode efficiency and critical anode current density in a manner which remains obscure. All of the plating variables under consideration are increased by an increase in temperature. In the ranges of current density covered, the anode and cathode efficiencies fall off as the current density is increased.

The unusual flexibility of the potassium stannate bath should be of particular interest in the electrotinning of steel strip, where high plating speeds are desirable and close control over plating conditions can be maintained. The superior stability of the potassium bath as observed in the laboratory shows promise of less tendency to form undesirable sludge. Further, the higher conductivity of the potassium stannate bath will also be of interest because of its effect in lessening power requirements.

Martin M. Sternfels, chemical engineer, Chromium Corporation of America, Waterbury, Conn., and Frederick A. Lowenheim, research chemist, Metal & Thermit Corporation, Rahway, N. J., before the 82nd general meeting of the Electrochemical Society, Detroit, Mich., Oct. 7-10, 1942.

A NEW SOURCE OF TITANIUM FOR AMERICAN INDUSTRY

DETERMINED TO obtain a domestic source of titanium for manufacture of titanium dioxide paints, the National Lead Co. purchased and developed a portion of the long-dormant Adirondack ilmenite-magnetite deposits. These deposits are located on the east shore of Sanford Lake and on Iron Mountain, a mile and a half to the northeast.

Engineers of the company first visited the MacIntyre property April, 1941, and in July, 1942, just 15 months later, initial operation was started and concentrates produced.

The main purpose of the National Lead Co. in opening up the ore deposit of the MacIntyre development was to provide a domestic source of raw material for its two large plants in St. Louis and at Sayreville, N. J., both of which are engaged in the production of titanium pigment. About 1,600 men are occupied in manufacturing National Lead's "Titanox" pigments.

The Sanford Lake ore body is an irregular deposit as a mechanical mixture of ilmenite and magnetite formed by magmatic segregation. Over 11,000 ft. of diamond drill cores, taken out of 70 drill holes, showed that above the level of Sanford Lake approximately 15 million tons of ore exist, analyzing 18 percent titanium dioxide. This

should provide raw material for the titanium pigment industry of the United States for at least ten years.

The program of operations calls for the mining of 4,500 tons of ore daily from which the mill will produce 900 tons of ilmenite, and as a co-product approximately 1,800 tons of magnetite low in phosphorus. The final product thus obtained is an ilmenite containing approximately 48 percent titanium dioxide.

Operation of the concentrating plant requires more than 7,000 gal. per minute of water from Lake Sanford. Two 5,000 gal. per minute electrically driven pumps force the water through a 24-in. main to a reservoir approximately 225 ft. above the lake-level. For the operation of the plant a maximum of 5,000 kw. is necessary. This is purchased but for its delivery it was necessary to build a 100,000-volt high-tension line from Ticonderoga, N. Y.

A further possibility has been found in the discovery that the magnetite also contains 0.35 percent vanadium. Research on methods for the recovery of this vanadium is now under way.

I. V. Hagar, assistant manager, Titanium Division, National Lead Co., New York, N. Y., before the fall meeting of the Industrial Minerals Division, American Institute of Mining and Metallurgical Engineers, Bethlehem, Pa., Oct. 24, 1942.

OKLAHOMA MINERAL INDUSTRIES CONFERENCE HELD AT OKLAHOMA CITY

Chemical industries being developed to meet war needs have bright prospects for development or expansion into permanent enterprises in Oklahoma, Texas, and other states, agreed several of the speakers before the Oklahoma Mineral Industries Conference, Oklahoma City, December 10. Papers were read by about a dozen leaders of varied industries interested in mineral and chemical developments in Oklahoma and surrounding states. Important manufacturing enterprises that have located in this area within the past two years include three large coal mines in eastern Oklahoma, coke ovens and blast furnaces at Daingerfield and Houston, one carbon black plant in northwestern Oklahoma, an ammonia plant in Kansas and a big powder plant in Oklahoma.

Robert H. Dott, director, Oklahoma Geological Survey, gave a paper on the ground water supply at the State. J. G. Puterbaugh, president, McAlester Fuel Co., revealed that the three new coal mines in Oklahoma will produce approximately one million tons of coal per year and will be useful in manufacturing coke for the Texas blast furnaces. B. W. Logue, chief chemist, The Texas Company, Tulsa, explained several processes of recovering magnesium from Oklahoma oil field brines.

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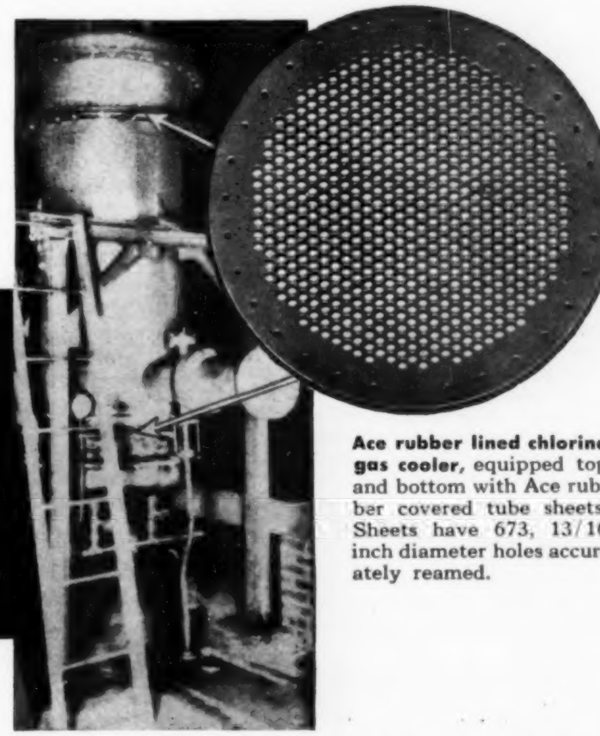

Ace rubber lined chlorine gas cooler, equipped top and bottom with Ace rubber covered tube sheets. Sheets have 673, 13/16 inch diameter holes accurately reamed.

UBBER PROTECTION

for Defense against Corrosion

SHORTAGES IN PLANTS, LABOR, AND MATERIALS FORCE ADJUSTMENTS IN BRITISH CHEMICAL INDUSTRY

Special Correspondence

PLANNING is very much in the foreground of British economic discussion. Repair of the damage caused by enemy air raids will require careful adjustment to the country's changed industrial and housing needs after the war, and organization from the top to the bottom will in any case be necessary if the whole economic life is not to be upset. But now, no less than after the war, planning is needed to insure that plant, labor and material is used to the greatest advantage for the war effort, for the limits of further expansion of production are clearly visible. In the British chemical industry the need for planned development has found expression in several ways. Shortage of labor has necessitated a change-over from civilian consumption goods to products of war importance; some firms have been "concentrated" and "telescoped", many plants have been converted to war productions or storage. Shortage of plant has had very much the same effect; it is amazing to what extent peacetime industries have adapted their equipment to wartime needs. The shortage of material, finally, has imposed a special strain on British chemical manufacturers because they are called upon to provide substitutes for many of the commodities which used to be imported from abroad; the British chemical industry, and in particular the makers of plastics and coal derivatives, have helped greatly to reduce the demand for metals and other "critical" materials.

The appeal to British farmers for an increase of food production has resulted in an expansion of the acreage under the plow from 16 to 22 millions, and another 1,000,000 acres are to be subjected to more intensive farming this year. An expert who combines farming experience with a knowledge of the chemical industries has estimated that the optimum consumption of chemical fertilizers in British agriculture would be 3,680,000 long tons of sulphate of ammonia, 1,130,000 tons of basic slag or superphosphates, 474,000 tons of muriate of potash, and 16,600,000 tons of calcium carbonate. Needless to say, present fertilizer consumption in the British Isles is far smaller. The proposed annual application of just over 2 cwt. of sulphate of ammonia, just over $\frac{5}{8}$ cwt. of phosphatic fertilizer, $\frac{1}{4}$ cwt. of muriate of potash, and about 10 cwt. of lime per acre would mean increased sales of nitrogenous fertilizers and lime for home producers, while most of the phosphatic and all of the potassic material would have to be imported, as it is now. At present these two fertilizer elements are supplied only in limited quantities for application to those crops which need them most.

One of the chemical industries which is to be concentrated is the paint and varnish trade. According to plans drawn by the Concentration of Production Department of the Board of Trade, only 181 out of some 500 paint manufacturing firms in the country were to be given "nucleus" status qualifying them for continued operation, but this plan has called forth fierce protests from the industry, and the official scheme has been withdrawn for the time being while the manufacturers try to develop a voluntary plan for concentration of their own. If the paint trade is concentrated as proposed under the Board of Trade scheme, one-quarter of the 5,000 workers employed in paint factories might be set free, and many of them are old people. In spite of the small number of workers affected, the authorities insist on a thorough concentration.

The cosmetics industry also has been the object of a concentration scheme, and in this case the authorities have used the novel idea of granting somewhat higher production quotas to firms which were prepared to leave their factories (to be used for war purposes) and transfer their production to other towns. These received a 50 percent quota, whereas others had to be content with 20 percent of their standard output. Nevertheless, by no means all firms have availed themselves of the higher quota, while those who have and consequently use more raw material seem to have caused some difficulty in the supply of basic materials. While manufacturing activities thus present few difficulties, the question of raw materials still faces the industry. Nor is there much hope in present conditions that the authorities will permit larger consumption of important materials for the manufacture of cosmetics.

The British cement industry has received a valuable addition in the form of a slag cement factory which is now being built in Wales and will be ready for production in February. When the plant is in full production, a saving of approximately 7,500 long tons of coal annually may be expected, and were it not for the transport problem, it would probably be advantageous to extend the production of slag cement to other works. Apart from fuel, the cement industry is at present especially interested in savings of transport and labor, and several new developments promise to be of assistance in this respect. A new flotation process is said to permit the use of raw materials of varying contents of lime, silica, alumina, and iron, as a final product of any desired composition can be turned out without correction. A reduction in the cost of quarrying sufficient to offset the additional cost of the process, an important gain in strengths, and lower fuel consumption are claimed as advantages of this process.

Coal-tar pitch is entering more and more new fields as a substitute for formerly imported materials. The British Standards Institution now recommends, at the request of the Ministry of Works and Planning, a coal-tar pitch felt for damp-proof courses, which is likely to be the only suitable alternative to bitumen felt damp-proof courses during wartime. Pitch damp-proof courses, however, are intended only for temporary wartime buildings and are not at present considered suitable for permanent construction. Full-scale tests have been made with roofing materials based on pitch, and many importers of bituminous materials now turn to coal-tar pitch, still a material in ample supply, with a view to the development of wartime substitutes for building and allied construction.

The shortage of tin attracts attention to low-percentage tin solders and other alloys which do not contain any tin at all. A silver brazing alloy is recommended because of its low melting point (630 deg. C), great tensile strength (30 tons/sq.in.), and easy removal of residues. These advantages are said to make up for the high cost. Usable for all metals except aluminum, zinc and magnesium-base alloys, it penetrates into small clearances and gives clean joints requiring little finishing. The General Post Office has ordered a reduction in the amount of solder used on cable joints; one-third of the amount of solder used previously is considered sufficient. Lower tin contents are permitted in solders used for smaller service cables and for wire-ends of connection tags in telephone exchanges.

There are many possibilities of substitution open to manufacturers of polishes and similar products, but wartime restrictions have caused great inconvenience, and British polish makers have had to experiment with a large number of substitute products. These include, on the one hand, synthetic waxes and, on the other, auxiliary products which, if they cannot be used alone, at least help to reduce the consumption of the commodity in short supply. Stearine, oleine, rosin, linseed oil, sulphonated oils, and soap belong to the latter class, but more attention is at present given to the possibilities of using synthetic waxes which are offered in the form of various proprietary brands; glycol-stearic acid ester, glyceryl stearate, chloronaphthalene, and cetyl-stearyl alcohols are being used and yield synthetic waxes of pale color, high melting point, low acid value, low specific gravity, and good solubility in the usual solvents. White pigments used in shoe polishes may be replaced by China clay.

Increasing importance of synthetic chemical products and organic chemicals generally has naturally given encouragement to those who propagate an extension of the coal processing industry, and great progress may be expected in that direction after the war; much indeed has already been

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done in the difficult conditions prevailing now.

Meanwhile the discussion about the pro and con of a British oil refining industry has been revived. Wartime experience does not point clearly in one direction. France, with a local refining industry capable of supplying almost all the needs of the country, did not fare better than England, without such a large refining industry. The transport problem also works both ways. Crude oil can be shipped easier but takes up more space. Refined products may need special containers and further treatment owing to the presence, not always avoidable, of impurities. The supporters of an oil refining industry for Great Britain base their case largely on two arguments which are of special interest to the chemical engineer. The first is that an oil refining industry supplies many byproducts which in turn can become the starting materials for chemical processes. The other argument is that a local refining industry, with its well-known high demand for replacements and modernization expenses, would provide chemical apparatus makers with valuable orders.

Wartime developments in shipping and food storage have stimulated interest in refrigeration chemicals. Dichlorodifluoromethane, the only present source of which is in the United States, has many friends because it is non-toxic and of low vapor pressure. Good use seems to be made of the so-called "cascade" system which employs ethylene or some other low-temperature refrigerant for the last stage, while ammonia or carbon dioxide may be used for higher stages.

GERMAN INDUSTRY MAKES MORE EXTENSIVE RESEARCH INTO DEVELOPMENT OF WOOD CHEMISTRY

Special Correspondence

EDITOR'S NOTE: *Cut off from direct correspondence with all except a few foreign sources in neutral countries, these notes interpret recent developments in continental Europe as reported in publications and official documents received in the United States. These monthly letters, prepared in this country, will be continued only so long as pertinent material of interest to American chemical industry is available for our comment and interpretation.*

WOOD CHEMISTRY, important during the Reich's half decade of war preparations, has assumed greater significance since the war. There are indications that in view of transportation difficulties, labor shortages, and the realization that wood supplies are not unlimited, wood chemistry is entering a new phase of development. Whereas it was formerly considered wasteful to use wood for burning for fuel, there is now a growing feeling that timber stands are even too valuable to be used for cellulose for making paper and textiles.

Research in some of the heretofore relatively unexplored branches of cellulose chemistry is accelerated. With the beginning of the winter semester 1942-3, an Institute for the Chemical Technology of Synthetic Fibers was opened at the Institute of Technology at Breslau. This institute in Silesia is sponsored by the Phrix Werke A.G., an important synthetic fiber concern. The location of the new institute at Breslau in the eastern part of Germany was partly due to the proximity to Silesian and eastern European forests. A similar Institute for Synthetic Fiber Research has also recently been established at the Institute of Technology in Munich, also near forest areas. Head of the new institute, which has the backing of the Sueddeutsche Zellwolle A.G. of Kelheim on the Danube, is Dr. H. Erbring. Among the problems occupying the attention of these institutes as well as manufacturers is improvement of process and equipment to free part of the three million workers employed in production and distribution of textiles in Germany for other jobs.

One of the chief problems being studied is some means of expanding the raw material basis for synthetic fibers, which now supply from 50 to 60 percent of the European textile supply. Attemps are being made to shift the raw material basis from slow-growing timber to annual and biennial plants, and utilizing heretofore wasted cellulose sources thereby freeing wood for more "valuable" purposes. To supply a cellulose demand of over 400,000 tons a year for the German synthetic fiber industry, 1 million tons of wood are required. This is estimated to be only a small part of the total cellulose production, the paper industry being a much larger cellulose consumer.

As time goes on, the staple fiber and paper pulp industries are growing farther apart in Germany since their interests in type of cellulose differ and since their location interests differ, paper pulp mills being best situated near remote timber stands and the staple fiber industry near cities where labor is available. The interests of the staple fiber producers require their production from raw material to finished fiber to be as compact as possible and thus to be independent of transportation of imported cellulose.

In addition to using forest woods, a number of other products are now experimentally used including esparto grass, flax and hemp waste, broom, hop vines, potato tops, corn stalks, grape, rye and wheat straw, sunflowers, and reeds. The use of reeds is being investigated carefully by the Ager Cellulose


Suggestions FOR OBTAINING CARBON DETERMINATIONS
Carbon determinations on steel samples are daily routine in metallurgical plants. Short combustion boat life is the bane of analysts. Norton research resulted in the development of a long life zircon boat. Samples were presented to an analytical laboratory for trial. These have served exclusively ever since—averaging 50 determinations each.
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G.m.b.H. in Vienna and the Sueddeutsche Zellwolle in Kelheim. Whereas the yield in synthetic fibers is estimated to average one ton per year per hectare of forest, it is estimated to be 9 tons per year per hectare of reed of the Danubian type "Arundo Donax." About 40 tons of cellulose can be produced from 100 tons of reed. If one-fourth of the reeds in the Danube delta were harvested and processed, about 475,000 tons of cellulose could theoretically be obtained as against present yearly production of 40 to 50,000 tons of cellulose a year in the Rumanian delta area. The yield would be lower than this with domestic German reed, chiefly "Phragmites Communis," but the problem of cultivating, harvesting, and transporting reeds is being carefully investigated and may lead to the introduction of higher yield reed plants and commercial cultivation in German delta and swamp lands.

Potato tops could theoretically yield 300,000 tons cellulose a year in the Reich, but collecting and cleaning as well as extracting cellulose from them still present difficult problems. Processes are still far from being economic. The Vereinigte Strohstoff Fabriken of Dresden Coswig, processing straw, has apparently shown consistent operating losses, including a loss of nearly half a million Reichsmarks in 1941. The A. K. U., Dutch rayon manufacturer, according to earlier plans, however, should now have started operating its new staple fiber plant using straw as a raw material.

Another problem coming in for the attention of the scientific institutes and industries is that of obtaining types of cellulose from this wide variety of cellulose sources best suited to making cell-wool. Since 1939 increasing use has been made of "pre-hydrolysis." By treating the raw material with weak acid (chiefly HCl) with or without pressure, a better grade of cellulose for making staple fiber, or cell-wool, is obtained. Experiments carried out by the Thuringsche Zellwolle A. G., Schwarza, with "chlorsulfate" pre-hydrolysis, have succeeded in raising the alpha cellulose content from 90 to 95 to 97 percent, with easier removal of pentosans. With rye straw an alpha cellulose content as high as 98.43 percent with an overall cellulose yield of 31.28 percent in terms of rye straw has been obtained.

The hemicelluloses removed by the preparatory hydrolysis are being studied carefully for utilization possibilities. The hemicelluloses, which must be removed either in pre-hydrolysis or later alkalization to prevent deterioration of the fiber, contain 3 to 4 percent sugars, which after fermentation with "Torula Utilis" with addition of phosphate and ammonium salts, can be transformed into a yeast rich in vitamin B1 and B2, suitable, it is claimed, for animal or even human consumption. The Phrix company reports that in one of the larger cell-wool plants, 50 to 60 tons of yeast, of which 50 percent represents proteins, can be produced per day. With the present production of chemical fibers in Germany it is accordingly estimated that 100,000 tons of pure protein

could be manufactured from this source, formerly wasted.

Since the German cell-wool industry is one of the largest consumers of heavy chemicals, sulphuric acid (400,000 tons a year), caustic soda (360,000 tons), and carbon bisulphide (140,000 tons), attention is also being paid to improving chemical recovery processes. The central I. G. Farben synthetic fiber laboratory at Wolfen reports that considerable progress has been made, but that there are still difficulties. Because of the shortage of copper, special interest is being paid to recovery of copper and ammonia used in the relatively small amount of cuprammonium rayon and cellwool produced. Spinning bath "blue waters" are being passed over "Wofatites," new type synthetic resin exchange absorbers, which permit satisfactory recovery of copper and ammonia.

Recovery of chemicals in the viscose fiber process, which accounts for the largest percentage of total fiber production, has not yet been satisfactorily solved. Up to 35 to 40 percent of the carbon bisulfide can be recovered. The recovery of sulphuric acid and caustic soda from the 300,000 tons or so of sodium sulphate resulting annually in the spinning baths is admittedly more difficult, and uneconomic. Electrolysis in a specially constructed vertical cell (I. G., German patent 692,954) with a mercury cathode has permitted at least partial recovery of a 20 percent sulphuric acid with 15 percent sodium sulphate anode solution.

Although improvements averaging 50 to 100 percent are reported to have been made in some of the properties of staple fibers between 1935 and 1941, there are still some serious drawbacks. One of the worst is the fact that cell-wool textiles do not wear as well as those of natural fibers and are badly attacked by the strong alkali "ersatz" soaps now being used in the Reich. Another bad quality is "swelling." Normal viscose cell-wool when first processed holds back 150 grams of water per 100 grams of cellulose, Cuprama and Lanusa types, 250 to 300 grams water, according to the Wolfen laboratories. This means that when spun, viscose fiber is only one-third cellulose and the other two-thirds represents waterfilled capillary space. In drying, the swelling properties are reduced, but when wet again the first time, 100 grams of dry fiber will absorb 100 grams of water.

The problem of reducing flammability of cell-wools and rayons so they can be used for wrapping electric wires, etc., is claimed to be solved through using wolframates in a new process. A sodium wolframate solution is first applied and then a dilute tin chloride solution to give tin wolframate impregnation. Aluminum and zinc wolframates have also been tried as well as a combination of wolframates and phosphates. Direct production of non-flammable rayon by the acetate process has been carried out by adding to the spinning solution small amounts of ortho-wolframate and nickel borate, together with Mg-NH_4 orthophosphate, Ca-NH_4-dimetaphosphate, and Zn-NH_4-orthophosphate.

CHEMICAL ENGINEER'S BOOKSHELF

BRIMSTONE'S BIOGRAPHY

THE STONE THAT BURNS. By *Williams Haynes*. Published by D. Van Nostrand Co., New York, N. Y. 345 pages. Price $3.75.

Reviewed by *S. D. Kirkpatrick*

CHEMICAL INDUSTRY'S foremost historian has given us another highly readable and intensely interesting story of a great American industry. Even those who are most familiar with the basic importance of sulphur as our chief chemical raw material may fail to realize that ours is not a God-given monopoly. True, we have remarkably abundant resources but they would never have been available for man's many uses had it not been for the equally remarkable resourcefulness of the man who deserves to be known as America's first chemical engineer. The story of Herman Frasch, which Mr. Haynes so ably tells, is in itself an inspiring record of American courage and determined perseverance that culminated in one of the outstanding chemical engineering achievements of all times.

Our present great good fortune in having above ground more than ample supplies of sulphur to meet almost any conceivable war needs contrasts strikingly with the scarcities that worried us so much in World War I. What happened then to stimulate the doubling and eventually the trebling of production is described in interesting detail from the human as well as the industrial and statistical points of view. The resulting book is one that chemical engineers will thoroughly enjoy reading and will want to keep around for a long time as a convenient source of reference.

There are, unfortunately, a few minor technical errors—such as the fact that there is no "Glauber" tower in a chamber plant; that nitrogen oxides do not trickle down the tower but actually flow the other way as soon as released from combination; that sulphur trioxide does not pass from the tower to the chambers in any controlling amount; that the chambers are not lead "lined"; that Gay Lussac acid is not "weak" in any sense of the word. But these are indeed slight blemishes on an otherwise nearly perfect work, and they can readily be corrected in the next edition.

THE MINERAL INDUSTRY DURING 1941. Vol. 50. Edited by *G. A. Roush*. Published by McGraw-Hill Book Co., New York, N. Y. 735 pages. Price $12.

MORE than ever before, this annual publication will be welcomed by those interested in the vital statistics of the mineral industries. In spite of world conditions, the editor has succeeded in including data and estimates on major minerals for a number of foreign countries. In addition to the usual chapters dealing with metallic and nonmetallic minerals, there is a very interesting 49-page report on the mineral industry throughout the world from 1892 through 1941. Statistics for major minerals are given in numerous charts and tables.

RANDOM THOUGHTS

INDUSTRIAL RESEARCH. By *F. Russell Bichowsky*. Published by Chemical Publishing Co., Inc., Brooklyn, N. Y. 126 pages. Price $2.50.

Reviewed by *Chaplin Tyler*

THIS little book might be called "Random Thoughts on Research." Product of well-rounded experience, it is written in a pleasing, informal style. The author starts with a chronicle of early inventions in transportation and illumination, telling how these inventions left a trail of obsolescence, teaching that no business can escape change. Then follows more regarding the economic consequences of invention, pointing out pitfalls in the path of those who invent.

After a chapter defining the field of research, the author swings into a discussion of the processes of invention and how inventions evolve in the research organization. Next subject is research for the small company and how such companies can be aided by the outside consultant. Final chapters deal with research organization and administration.

With few exceptions the book is convincing and sound. Occasionally, however, the reader bumps into such declarations as, "The sad fact is that work in industrial research laboratories is seldom as well done as that which is published by universities and scientific organizations" (p. 107); and ("You can pour in a quarter of a million dollars and have the research director come smiling before the board of directors and say, 'Well gentlemen, that proved to be the wrong hunch'" (p. 113). Possibly some research director did say that; the author however mercifully refrains from detailing what action the board took. But the questionable passages are few; altogether, the book is well worth reading.

AN OUTLINE OF ORGANIC NITROGEN COMPOUNDS. By *Ed. F. Degering, Carl Bordenca, B. H. Gwynn* and Collaborators. Planographed by John S. Swift Co., Inc., Cincinnati, Ohio. 381 pages. Price $6.

THIS outline in its present form is the first planographed edition of the accumulated notes of the senior author dealing with this extensive field of organic chemistry. It is intended to serve as a study outline for graduate students taking such a course as well as a handy reference guide for the research chemist doing academic or industrial work.

Degering has presented in a concise yet comprehensive form the essential chemistry of the organic nitrogen compounds. The work is not intended to be detailed or encyclopedic. The usual procedure in each chapter is to introduce briefly the class of compounds under discussion, then to summarize nomenclature, outline the various methods and conditions for preparation, including equations, list briefly outstanding physical properties, and finally to list and discuss the conditions governing laboratory and industrial reactions. The many bibliographical notes increase the value of the book as a reference.

ELECTRONICS

EXPERIMENTAL ELECTRONICS. By *R. H. Muller, R. L. Garman* and *M. E. Droz*. Published by *Prentice-Hall*, New York, N. Y. 330 pages. Price $4.65 (special to colleges, $3.50).

INSTRUMENTATION is, of course, vital for proper regulation of chemical reactions and processes. In recent years there has been a growing trend toward the application of electronic devices in control and recording instruments. Tubes are also being more widely used in the apparatus of industrial and university laboratories. For background courses in experimental electronics, designed to give a working familiarity with the non-communication uses of electron tubes, this book by three professors of chemistry will serve admirably as a text. Engineers, too, will find it interesting and helpful. Discussions of theory are not as complete as those found in standard works on electronics, but they are clear and adequate. In the 11 chapters which follow the introduction, there are 70 experiments with triodes, photoelectric cells, multigrid tubes, gaseous tubes, phototubes, tube voltmeters, oscillators, untuned amplifiers, and cathode-ray tubes. There are numerous problems for student consumption and many literature references for further study.

HOW COLLECTIVE BARGAINING WORKS. *Harry A. Millis*, with 16 contributing authors. Published by The Twentieth Century Fund, New York, N. Y. 986 pages. Price $4.

THIS factual survey of labor-management relations in leading American industries sets out to find just how collective bargaining works in practice, what actually happens when management and labor sit down at a table to bargain (or to fight) collectively.

Some 16 contributors have analyzed labor-management relations in major industries, including daily newspapers, book and job printing, building construction, bituminous coal, anthracite, railroads, men's clothing, hosiery, steel, automobiles, rubber products, glass, elec-

trical products, Chicago service trades, and miscellaneous industries.

Although the chemical and process industries actually occupy very little space in this volume, the chemical manufacturer (who, until recently, has largely been spared the agonies of "acute unionitis") can learn plenty from the experiences of other industries. And there are just two all-important reasons why the chemical industry should familiarize itself now with the various phases and techniques of collective bargaining: (1) never before in the history of the industry has there been a greater need for harmonious labor-management relations and (2) efforts by the unions to organize the industry will almost certainly be greatly intensified after the war.

RECENT BOOKS and PAMPHLETS

The Total and Free Energies of Formation of the Oxides of Thirty-Two Metals. By *M. deK. Thompson.* Published by the Electrochemical Society, New York, N. Y. 89 pages. Price $1. Presents equations calculated from the data in the literature. The 32 metals are: Al, Sb, As, Ba, Be, Bi, Cd. Ca, Cr, Co, Cu, Au, Fe, Pb, Li, Mg, Mn, Hg, Mo, Ni, Os, K, Ag, Na, Sr, Tl, Sn, Ti, W, V, Zn, and Zr.

Mogul Metallizer Process Manual. Published by Metallizing Company of America, Chicago, Ill. 64 pages. Price $2. An operating manual designed to assist users of metalizing equipment in the proper operation of metal spray guns.

The Specific Heats of Certain Gases Over Wide Ranges of Pressures and Temperatures. By *F. O. Ellenwood, N. Kulik* and *N. R. Gay.* Bulletin 30, Cornell University Engineering Experiment Station, Ithaca, N. Y. 22 pages. The gases studied are: air, carbon monoxide, carbon dioxide, methane, ethane, hydrogen, nitrogen, and oxygen. Temperature range is 0 to 4,000 deg. F. and pressures from 0 to 10,000 lb. per sq. in.

Simplified Pricing Methods for Re-Negotiation of Government Contracts. Published by the Eddy-Rucker-Nickels Co., Cambridge, Mass. 4 pages. Contains a condensation of certain principles and new pricing methods recommended for a client in view of the growing interest in and importance of government contract re-negotiation.

The Industrial Guard's Manual. By *H. D. Farren.* Published by National Foremen's Institution, Deep River, Conn. Price $1.25. Contains rules for guards covering subjects with which all guards should be familiar. Adaptable to large or small companies.

Industrial Inspection Methods. By *L. C. Michelon.* Published by Harper & Bros., New York, N. Y. 389 pages. Price $3.50. Dimensions control, testing for physical properties, surface inspection. Instruments and gages for measuring and testing are described and illustrated.

A. S. T. M. Standards on Petroleum Products and Lubricants. Published by the American Society for Testing Materials, Philadelphia, Pa. 442 pages. Price $2.25. Annual publication giving specifications, tests and definitions. New standards cover tests for neutralization number of petroleum products by color-indicator titration and by electrometric titration, rust-preventing characteristics of steam turbine oil in the presence of water, sludge formation in mineral transformer oil, and conversion of kinematic viscosity to saybolt furol viscosity.

An Outline of Organic Chemistry. Fourth edition. By *E. F. Degering.* Published by Barnes & Noble, New York, N. Y. 386 pages. Price $1.25. Supplement to the students' organic textbooks.

Process Practices in the Aircraft Industry. By *F. D. Klein, Jr.* Published by McGraw-Hill Book Co., New York, N. Y. 266 pages. Price $2.75. Concerns processes, methods and materials.

GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from Superintendent of Documents, Government Printing Office, Washington, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, express order, coupons, or check. Do not send postage stamps. All publications are in paper cover unless otherwise specified. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for its issue.

A Medical Study of Men Exposed to Measured Amounts of Carbon Monoxide in the Holland Tunnel For 13 Years, by R. S. Sievers, T. I. Edwards and A. L. Murray. U. S. Public Health Service, Public Health Bulletin No. 278. Price 15 cents.

Sixteenth Census of the United States: 1940—Manufactures 1939—Volume II, Part I—Reports by Industries, Groups 1 to 10. U. S. Department of Commerce, Bureau of the Census. Price $1.50, cloth bound.

Accumulation of Moisture in Walls of Frame Construction During Winter Exposure, by C. G. Weber and R. C. Reichel. National Bureau of Standards, Report BMS93. Price 10 cents.

Recommended Building Code Requirements for New Dwelling Construction, by Subcommittee on Building Codes, Central Housing Committee on Research, Design and Construction. National Bureau of Standards. Report BMS88. Price 20 cents.

Indebtedness In The United States 1929–1941. Bureau of Foreign and Domestic Commerce. Economic Series No. 21. Price 15 cents.

Survey of Current Business—1942 Supplement. Bureau of Foreign and Domestic Commerce. Unnumbered. Price 50 cents.

Graphical Correlation of Recovery and Product Composition in Separation Processes, by F. Fras. Bureau of Mines, Report of Investigations R. I. 3663. Mimeographed.

High-Grade Dolomite Deposits in the United States, by J. H. Weitz. Bureau of Mines, Information Circular I. C. 7226. Mimeographed.

State Occupational Legislation. Prepared by Marketing Laws Survey. Dept. of Commerce, unnumbered.

Cost of Living in 1941. Bureau of Labor Statistics, Bulletin No. 710. Price 10 cents.

Controlled Materials Plan. Official CMP Class B Product List December 21, 1942. War Production Board, unnumbered. This list supersedes the Class B Product lists published November 2 and November 14, 1942.

Federal Specifications. New or revised specifications which make up Federal Standard Stock Catalog on the following items: Floor Wax, liquid, solvent-type (with resins), section IV (part 5), price 5 cents; Insecticide, liquid (household) O-1-546, price 5 cents, Magnesium-silicate, dry (paint-pigment), TT-M-90, price 5 cents; Rosin, LLL-R-626, price 5 cents; Felt, asphalt-saturated, (for) flashings, roofing, and waterproofing, E-HH-F-191a, price 5 cents; Sodium silicate, liquid, O-S-605, price 5 cents.

Annual Reports. During December and January there have been released most of the annual reports of the various government bureaus and departments. Generally each such agency distributes its own report to those who request it. Only in a few instances are charges made, for example when an annual report includes a great deal of statistical information and thus is a very expensive document. The reports relate to the fiscal year of the government ended June 30, 1942.

MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Calgon. Calgon, Inc., Pittsburgh, Pa.—15-page Data Book featuring illustrations of various applications of this sodium hexametaphosphate sequestering and dispersing agent. Deals briefly with applications in water conditioning, elimination of scale from cooling systems, dispersing solids, controlling corrosion in pipe lines, as well as uses in food industries, dyehouses, ceramics, etc. Contains technical data on the product and a list of technical literature available.

Centrifugal Pumps. Allis-Chalmers Manufacturing Co., Milwaukee, Wis.—Form 6256—28-page booklet entitled "Handbook for Wartime Care of Centrifugal Pumps." Written in simple style with helpful diagrammatic sketches. Includes a handy reference card on how to locate trouble in centrifugal pumps.

Chemicals. Hooker Electrochemical Co., Niagara Falls, N. Y.—Pamphlets which give physical properties, specifications and industrial applications of this concern's sodium sulphide, sodium sulphydrate for the leather industry, sodium benzoate and paradichlorobenzene. Also a condensed list of the chemical products put out by the concern, a very brief description of each, industrial uses and types of shipping containers used for each chemical.

Chlorine. Hooker Electrochemical Co., Niagara Falls, N. Y.—Wall chart giving in condensed form safety rules for handling of liquid chlorine. Describes briefly proper procedure of handling containers, gas masks, leaks, and first-aid in case of accident.

Hydrofluoric Acid. The Harshaw Chemical Co., 1945 E. 97th St., Cleveland, Ohio.—Booklet containing a number of reprints dealing with anhydrous hydrofluoric acid. Gives data on solubility and physical properties, potential uses of hydrogen fluoride in organic chemical processes, properties as an alkylation catalyst in petroleum refining, hydrogen fluoride as a condensing agent, and recommended practice for safe handling and discharging of containers. Contains extensive engineering data on properties and materials of construction. Illustrated.

Petroleum Refining. The Lummus Co., 420 Lexington Ave., New York, N. Y.—Bulletin R-7—55-page notebook dealing with petroleum processes, design and construction. Discusses and illustrates this concern's Thermofor catalytic cracking, selective cracking, alkylation, isomerization, and other refining processes. Also deals with waste heat generators, oil heaters, heat-exchangers, etc. Contains flow sheets and descriptive material on a number of petroleum refining processes. Extensively illustrated.

Presses. The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.—Bulletin 4207—Ten-page bulletin dealing with the line of presses for process industries put out by this concern. Includes brief descriptive material and illustrations on laboratory, dehydrating, stocking and briquetting, forming, molding and extruding presses. Extensively illustrated.

Plastic Fabrication. E. I. du Pont de Nemours & Co., Plastics Department,

Arlington, N. J.—Handbook dealing with the fabrication of "Lucite" in airplane enclosures and in a wide variety of other products. Describes the various general methods of fabrication with which satisfactory results have been secured in industry, but makes no attempt to prescribe exact procedures followed in producing a specific type of finished article. Deals with forms, shapes and sizes of the plastics, care and handling, general fabricating information, sawing, blanking and punching, drilling and other fabricating procedures as well as with mechanical, thermal and miscellaneous properties. Extensively illustrated with drawings, photographic reproductions, and charts. Contains extensive data in table form.

Redwood. California Redwood Association, 405 Montgomery St., San Francisco, Calif.—4-page form which gives the properties and uses of California Redwood. Includes data on shrinkage and swelling, nail-holding power, composite strength values, working stresses, etc. Also forms which deal with the use of this redwood for reservoir roofs and for industrial fences. Well illustrated.

Refinery Equipment. Merco Nordstrom Valve Co., 400 Lexington Ave., Pittsburgh, Pa.—Bulletin V-139—New manual detailing selection of specific valves for refinery service, accompanied by recommendations regarding selections of metals for alloys and plug valve lubricants. Also lists various processes of refining and includes a glossary of about 200 refining terms. Also contains approximately 100 photographs of typical refinery valve installation showing general hook-up of lubricated plug valves and close-up views. Includes numerous cross-sectional drawings of the various types of valves put out by this concern.

Rosin in Soap. Hercules Powder Co., Wilmington, Del.—24-page booklet giving results of this concern's extensive research on the use of rosin in soap. Shows how the proper use of rosin imparts desirable properties to all types of soap, such as (1) quick and lasting suds; (2) improved solubility; and (3) reduced dusting of spray-dried soaps and flaked soaps. Discusses raw materials used, preparation of soaps, soap yields, color and hardness of soaps, water-holding property, solution rates, relative detergency, tallow-rosin soap, etc. Extensively illustrated with charts, disgrammatic drawings and photographic reproductions. Contains extensive data in table form.

Safety Heads. Black, Sivalls & Bryson, Inc., 7500 E. 10th St., Kansas City, Mo.—20-page catalog dealing with this concern's line of safety heads of various sizes and types. Each unit is illustrated and described briefly. Contains extensive dimension tables and price lists. Includes charts and installation photographs.

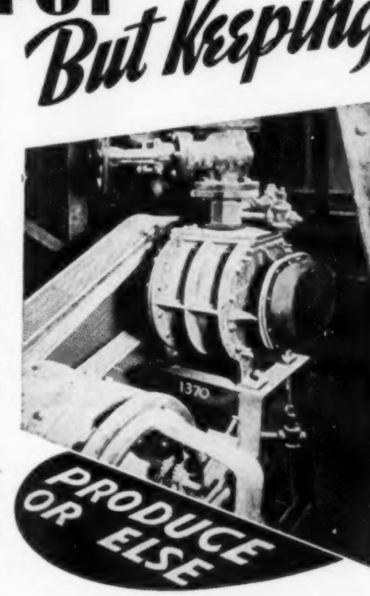
Skin Protection. Mine Safety Appliances Co., Braddock, Thomas & Meade Sts., Pittsburgh, Pa.—Bulletin FA79—16-page booklet dealing with this concern's "Fend" protector for worker's skin. Discusses briefly the subject of industrial dermatitis, advantages and features of "Fend" cream and lotions, and applications of the various types. Contains a ready application chart.

Steam Hose. The B. F. Goodrich Co., Akron, Ohio.—Section 4500—two-page form containing simple rules for care and maintenance of steam hose, attaching couplings, etc. Illustrated.

Valve Operators. Automatic Temperature Control Co., Inc., 34 E. Logan St., Philadelphia, Pa.—Catalog A-4—4 page sheet illustrating and discussing briefly this concern's line of Type "2" valve operators. Discusses general application, construction, and types, as well as design features and operating data. Contains diagrammatic drawings.

Water Filters. Graver Tank & Mfg. Co., Inc., East Chicago, Ind.—Bulletin 313—12-page booklet dealing with the pressure type water filters put out by this concern. Discusses and illustrates various features of the units, their advantages, and applications. Contains tables of specifications for pressure filters. Extensively illustrated.

Welding. Westinghouse Electric & Mfg. Co., Pittsburgh, Pa.—Form B3136—12-page booklet comparing advantages on a. c. and d. c. welding and describes the "Flexarc A-C" welders put out by this concern. Illustrated.



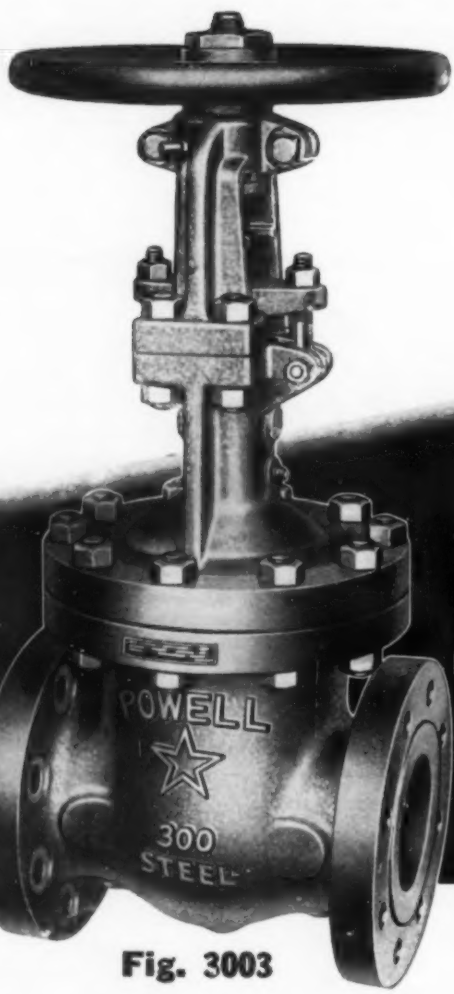


Fig. 3003

Fig. 9003 WE

Fig. 3003—Class 300 pound Cast Steel Gate Valve. Has outside screw rising stem and two-piece bolted flanged yoke. Available in sizes from 1¼″ to 24″ inclusive, with either flanged or welding ends.

Fig. 9003 WE—Class 900 pound Cast Steel Gate Valve. Has outside screw rising stem and two-piece bolted flanged yoke. Available in sizes from 3″ to 24″ inclusive, with either welding or flanged ends.

The complete Powell Line of Cast Steel Valves includes Globes, Angles, Checks, Gates, Non-returns, etc., for 150, 300, 400, 600, 900, 1500 and 2500 pounds W. P.—to meet the demands of American Industry for dependable flow control equipment to handle ever increasing pressures and temperatures.

POWELL

ECONOMICS AND MARKETS

FIRST-QUARTER RATE FOR INDUSTRIAL CONSUMPTION OF CHEMICALS ABOUT SAME AS LAST YEAR

Rates of operation in the principal chemical-consuming industries so far this year point to a use of raw materials in the first quarter of about the same volume as that for the corresponding period of last year. Total production and consumption of chemicals are higher than a year ago but the amounts going directly into war goods have been sharply expanded as may be inferred from the report on war production in 1942 as issued by the War Production Board. From a chemical standpoint, the diversion of materials to war purposes and the limitations placed on deliveries to regular consuming lines, have made but little difference in the way of industry distribution. Comparing present activities at consuming plants with those of a year ago brings out that the government request for larger crops has stimulated production of fertilizer chemicals. The greater use of steel has necessitated larger mill outputs. Moderate gains are also noted for rayon manufacture. Fairly even rates of operation hold good for glass, petroleum refining, coal products, and textiles. Pulp and paper mills are working well below the levels maintained in the Jan.-March months of last year but all these average out at close to the 1941 totals.

There is no reason to anticipate any radical change in the position of the consuming industries as the year advances. Further curtailment in production of pulp and paper is in prospect in line with the program adopted to cut down actual consumption. Outside of that, the prospective supply of chemicals should make it unnecessary to place any further limitations on their use. The synthetic rubber industry when it gets in its full rate of production as now revised for this year will be a large potential consumer of chemicals but new manufacture of the chemicals used in largest volume has been arranged in such a way that this will not disturb the regular market. Possibly more control will be exercised over distribution of alcohol but at present production has been going ahead of demand, so much so that questions of storage have arisen.

The index for consumption of chemicals for last December was 169.46 which compares with 172.50 for December 1941. For the last quarter of last year the average was 171.01 which represents a slight drop from first quarter operations when the average stood at 172.11. The paint and varnish industry was gathering momentum at the close of 1941 while it was on a downward swing at the close of last year. Heavy government purchases of paint materials may be expected this year—record amounts of red lead are now being called for—but this is one line where it is hardly possible for the years totals to compare favorably with the figures for 1942 because the building program for this year will fall far short of what it was last year.

So far as output of civilian goods is concerned, the overall effect of a rising war-goods program undoubtedly will be to cut down many lines of manufacture. Announcement has been made to the effect that programs mapped out and adopted for the second quarter of this year call for a drop of from 14 to 17 percent in certain lines of production. Some of this lopping off is to come from original estimates of production for military purposes, the synthetic program for instance, but the greater part probably will be taken from the less essential lines although no details on this curtailment are yet available. Many of these lines will have some bearing on consumption of chemicals since chemicals are almost universally used in industry. Yet, as previously stated, the large consuming outlets, with the exception of pulp and paper and paint and varnish are not likely to share in this policy of curtailment. That a good part of retrenchment will come from fields where metals are important raw materials may be seen from the fact that total requests for the second quarter exceed supplies by approximately 17 percent for carbon steel, 15 percent for alloy steel, 16 percent for copper, and 14 percent for aluminum.

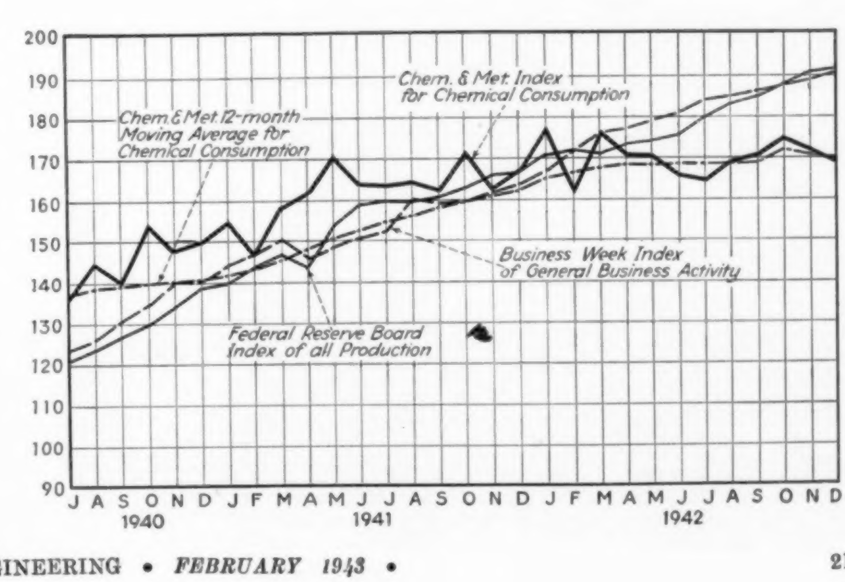
The Textile Economics Bureau in reporting on fibers used in making textiles last year, give the total at 6,847,000,000 pounds an increase of 6 percent above the previous high in 1941. Cotton and rayon consumption was at a substantially higher figure but wool consumption fell off because of restrictions for civilian use. Silk consumption was nominal throughout the year. The gain for cotton was reported at 8 percent and for rayon 5 percent. The loss for wool was 7 percent. In the present year, no reduction is anticipated in the use of cotton but the finished products may be dictated to a greater extent by military requirements. For instance, it is now reported that a larger number of looms will turn out osnaburg. Rayon likewise may be less plentiful for textile mills although its total use will surely be further increased. The wool situation appears very favorable inasmuch as the visible and prospective supply is larger than it was last year and it is possible that larger allotments will be made for civilian use.

Recent developments which have had an adverse effect on productive activities include labor troubles at a rayon plant which cut down the output in January. The shortage in fuel oil also was responsible for a slowing up in operations at textile plants in New England as nine mills were closed for a brief period because oil was not available. Limitation on sales of shoes for civilian use may have the effect of cutting down tanning operations.

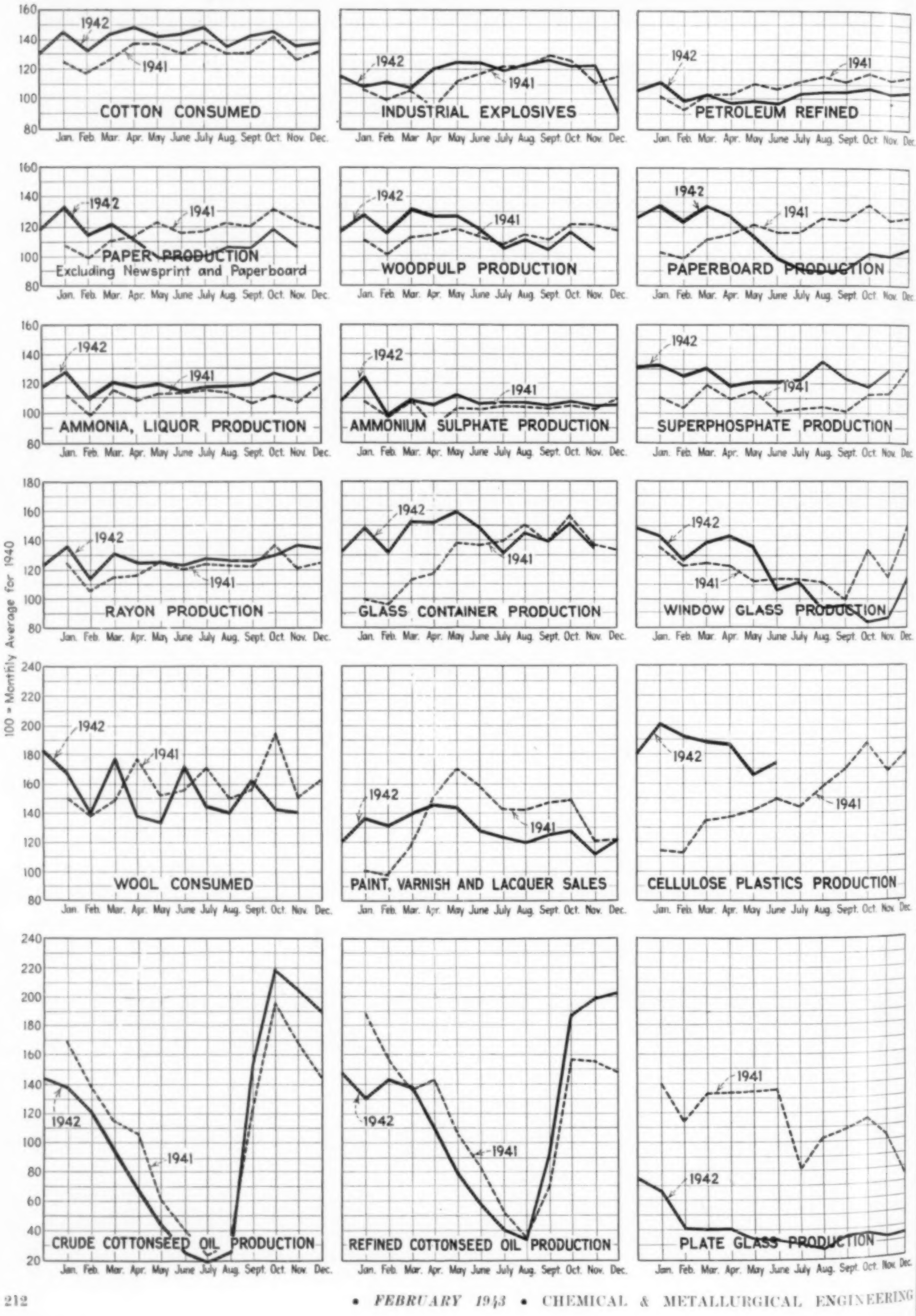
Chem. & Met. Index for Industrial Consumption of Chemicals

1935=100

	Nov.	Dec.
Fertilizers	40.11	40.30
Pulp and paper	20.01	19.30
Petroleum refining	14.61	14.87
Glass	15.20	16.10
Paint and varnish	12.38	12.06
Iron and steel	13.28	13.60
Rayon	14.91	15.46
Textiles	11.61	11.58
Coal products	9.38	9.52
Leather	4.75	4.70
Industrial explosives	6.05	4.47
Rubber	3.00	3.00
Plastics	4.40	4.50
	169.69	169.46



Production and Consumption Trends



ZONE PLAN FOR CONTROL OF SHIPMENTS OF CAUSTIC SODA WILL BECOME EFFECTIVE APRIL 1

What amounts to an innovation in the distribution of chemicals will be tried out beginning April 1 when shipments of caustic soda will be limited to definite zones which have been arbitrarily set up. The country has been divided in 13 sections or zones and shipments of caustic soda originating in a given zone will not be permitted to cross the limits of that zone. This plan has been in the works for some time and considerable time and energy have been expended in working out the details. The 13 zones were carefully worked out so that production and requirements in each of the areas are in close balance.

The reason leading up to the formation of this plan is found in the scarcity of tank cars. A survey of this situation brought out that the elimination of cross hauling would ease the general shipping situation. The tank car situation had become so tight that an order was issued on Jan. 9 which provides for the allocation of tank cars for shipment of chemicals after March 1. The rise in consumption of chemicals in the last two years has strained distribution facilities and the rise in demand for tank cars has not been accompanied by a corresponding increase in production of such cars. The chemical industry uses about 15,000 tank cars of which about half are special units designed for handling but one material.

There is nothing in the regulation to worry the shippers. The railroads are the one that will worry because it appears that the pattern of business may be permanently changed and that the long cross hauls common before the war may be a thing of the past. Producers of caustic soda who can ship from any one of a number of plants may not feel the restrictions of the order at all or at least not seriously.

Transportation Request No. 1 relating to tank cars provides that "All persons engaged in producing, transporting or distributing materials listed on Schedule X annexed (herein referred to as Schedule X) shall make such purchases, sales, exchanges, or loans of Schedule X materials, and shall arrange for the common use of tank cars and tankage facilities as may be required to attain the most efficient utilization thereof." Schedule X lists 38 chemical products or groups of products commonly handled in tank cars.

This provides a means within the law for producers to get together voluntarily to exchange customers and to make other arrangements. It would be possible for producer A in the Chicago area to arrange with producer B in the New York area to make shipment to one of A's customers with the invoice coming from A as before.

Reports of such arrangements must be made to the War Production Board. It is not necessary to report every transaction. All that is required is a report of the agreement to swap customers or goods or to perform services. Tr-I is not mandatory. It is a request for voluntary action by the industry in the hope that every one will take advantage of the opportunity afforded.

Both Transportation Request No. 1 and General Transportation Order T-1 must be studied with care. The General Transportation Order has 3 lists attached. The first list covering zoned shipments of molasses—which after March 1 can not be shipped more than 200 miles without special permit except for manufacture of yeast and citric acid—and caustic soda. List 2 gives 6 materials with permissible shipping distances for tank cars or trucks. Shipments on this list must be reported 10 days before the shipment is made. List 3 specifies commodities that may be shipped without restriction. Materials not on one of these lists may not be shipped in tank cars without specific permission unless consigned to certain government agencies.

List No. 3 is a comprehensive list of chemicals that would normally be shipped in tank cars. If any chemical has been omitted request to the War Production Board on the prescribed form will bring authorization to make shipment.

By means of the controlled shipment plan it is hoped that future requirements for cars can be met within the chemical industry. It is not designed to release cars for the shipment of oil. If the zone plan proves successful with caustic soda it may be extended to include other materials shipped in tank cars or to relieve shortages that may occur in other types of cars.

There has been no announcement of any change of policy in OPA relative to price regulations for chemicals but costs of production are being obtained for a list of chemicals which, according to some reports, is to be used as basis for price schedules for different products with a range according to seller. Whether this is to stimulate production by allowing higher cost producers to get more for their products or is an attempt to establish a general lower level for chemicals is not clear but if sales sched-

CHEM. & MET.

Weighted Index of

CHEMICAL PRICES

Base=100 for 1937

This month	**108.89**
Last month	108.92
February 1942	109.20
February 1941	99.98

Most important price development in past month was a material lowering in quotations for phenol. For the most part the market was firm and unchanged with contract deliveries accounting for the bulk of distribution.

ules should be fixed at a small margin over production costs of the more efficient plants, higher cost producers might not be able to operate except at a loss which would not be favorable for holding total production up to the level required.

Another rumor is concerned with a chemical used in the war effort for which it is said prices will be fixed below cost of turning it out, the assumption being that the manufacturer will absorb the loss from profits made from other departments which are working on large war contracts. It is held that price reductions based on larger volume of output will create a problem when the war volume disappears. It will be difficult to make upward price adjustments even though lower outputs may increase unit costs.

Delays in getting official sanction for prices for new products have given some concern. In the case of insecticides it was recently announced that manufacturers might fix prices themselves by computing the cost of ingredients in the new product, comparing it with the old product most like it in kind and cost of manufacture, and adjust the sales prices by the amount of difference.

Beginning April 1, manufacturers, processors or packers of chemicals, foods, fertilizers, plaster, cereals, starch or sugar may pack their products only in the following specified sizes of textiles or paper bags: 2, 5, 10, 25, 50, 100 or over pounds. The purposes for which new cotton bags may be used are restricted to 21 types of commodities, including chemicals, cement, fertilizer, glues, gypsum, etc. A number of chemicals are being shipped now in multiwall paper bags that differ in capacity from those stipulated in the order, due to characteristics of density, etc.

It is felt that restrictions of Order M-221 are in such conflict with present chemical practices of packaging that unless they are revised they will result in substantial hardships to the industry. Chemical interests claim that Bessemer steel sheets are suitable in many cases for drums of gauge 24 or lighter, which are extensively used for the shipment of carbide, alkalis and other chemical products, and are available for conversion into metal drums. Interstate Commerce Commission regulations prohibit use of Bessemer steel in ICC specification barrels and drums.

CHEM. & MET.

Weighted Index of Prices for OILS & FATS

Base=100 for 1937

This month	143.13
Last month	142.32
February 1942	139.36
February 1941	75.45

Limited supplies of oils continue to hold the market in a strong price position. The upward swing to linseed oil values continued although demand was far from active. Cottonseed and soybean oils command full ceiling prices.

ALLOCATION ORDERS FOR DISTRIBUTION OF CHEMICALS IN JANUARY SHOW GROWING MILITARY NEEDS

REPORTING on the distribution in January of those chemicals which are under allocation, the Chemicals Division of the War Production Board gives a clearer picture of the extent to which production of military goods is making demands upon raw materials. The allocated chemicals in January carry a valuation of $85,400,000 of which $56,400,000 entered directly into identifiable military production. In addition, many derivatives of the 34 percent not identified as direct military are necessary for the production of military items. The figure of $56,400,000 per month is also exclusive of military purchases of chemicals not under allocation. The accompanying tabulation reports the civilian end uses to which the various chemicals under allocation were alloted. The percentage figures show the relationship between the amounts requested and allotted. Because of excessive inventories or other causes not all individual consumers were granted the right to buy new material to the amount indicated. Allocations were on the following basis:

Acetic Anhydride—Following uses were granted in full: plastics—acetobutyrate; plastics—acetopropionate; synthetic casein fiber; pharmaceuticals (other than aspirin, acetophenetidin and acetanilid); synthetic vitamins; intermediates and dyes; cation softeners; synthetic flavoring and perfume; and laboratory reagents and research.

Following were granted in part: cellulose acetate yarn (87%); cellulose acetate staple fiber (90%); cellulose acetate plastics and films (90%); aspirin (90%); acetanilid (77%); and acetophenetidin (59%).

Acrylic Resins—Granted in full for health supplies and for the Health Supplies Division's quota for dentures; denied for hearing aids and for tracing cloth coatings.

Acrylonitrile—Allocated entirely to synthetic rubber with the exception of a very small quantity for vitamin B complex.

Ammonia, Anhydrous—Granted in full for activated carbon, amines, cellophane, chemical manufacturing, drycell batteries, dye intermediates, industrial explosives, film and photographic chemicals, food processing, insecticides, metal treating, nitrous oxide, petroleum, plastics and synthetic resins, rayon manufacture, refrigeration, resale, silica gel catalyst, sulphuric acid, textiles, and water treatment. Granted in part for nitrocellulose (92%).

Ammonia, Aqua—Granted in full for ammonium bifluoride, ammonium chloride, copper sulphate, corrosion control, chemical manufacturing, di- and mono-ammonium phosphate, dye intermediates, industrial explosives, metal refining, mildewproofing, pharmaceuticals, rayon manufacturing, resale, silica gel, soda ash, sulphuric acid, textile finishing, yeast manufacture.

Ammonium Sulphate—Granted in full for agriculture, alcohol, dyes and pigments, cellulose, fire retarding, insulation, leather tanning, rayon, textiles, and yeast.

Aniline—Granted in full for rubber chemicals, drugs, dyes, inks, photographic chemicals, petroleum chemicals, plastics, mining flotation reagent, and fine chemicals.

Benzene—Granted in full for nitrobenzene, camphor, monochlor-benzene, dichlor-benzene, medicinals, and rubber chemicals; granted in part for anthraquinone (79%), diphenyls (78%), miscellaneous chemicals (60%), trichlorbenzene (54%), solvents (25%), and aniline (94%).

Butadiene—Allocated entirely to synthetic rubber.

Butyl Phthalyl Butyl Glycollate—Granted in full for lacquers. No other use requested.

Calcium Carbide—Granted in part (54%) for resale. This is estimated to be sufficient for all small lot local users.

Calcium Hypochlorite, High Test—Granted in full for sugar refining. Other requests—principally for water purification—were granted to the extent of 32%.

Capryl Alcohol—Denied except for the manufacture of dicapryl phthalate and use in oil additives, which were allowed in full.

Carbon Black, Furnace Type—Allocated only for the compounding of rubber. Denied for ceramics, paints, and inks, where other carbon blacks of the channel or lampblack type can be used. Shell reclaim and briquettes are unsuited for pigment purposes but can be used in the steel industry. They are allocated to that industry alone.

Castor Oil—For protective coatings allocated only for insulation finish, and innerlings for food containers. In these uses requests were granted 50% if tung oil could be substituted. In all other instances in these uses, requests were granted in full.

Granted in full for industrial tape, adhesives for food packages, hydraulic fluid, dielectrics, and hospital supplies.

Granted in part for gaskets and brake linings (75%) shoes (30%—to be used only for quarter linings, bindings, innersole, and uppers); lubricants and metal working oils (50%); medicinals (50%); mimeograph ink (40%); inks for ribbons and carbon paper (50%); boiler feed water treating compound (50%); and petroleum treating compound (90%).

Denied for rainwear, for health supplies for others than hospitals, for household use, books, upholstery, cosmetics, and plasticizer for miscellaneous purposes.

Castor Oil Phthalate—Granted in full for all uses requested.

Castor Oil Phthalate, Hydrogenated—Denied for cellophane. No other uses requested.

Chemical Cotton Pulp—Granted in full for all uses subject to the restrictions of several limitation orders governing its use.

Chloric Acid—Granted in full for fur carroting. No other uses requested.

Chloride of Lime—Allocated principally for sanitary purpose, to the extent of 88% of requests.

Chlorinated Paraffin—None allocated for civilian consumption.

Chlorine—Granted in full for uses except the manufacture of wood pulps, where requests were filled 86%, and the manufacture of sodium hypochlorite, where requests were filled 90%.

Copper Chemicals—All requests in full subject to 30-day or practicable minimum working inventory restrictions.

Diamyl Phthalate — Small quantities granted in full for miscellaneous uses. Granted in part for lacquers (17%).

Dibutoxy Ethyl Phthalate—Granted in full for coatings. No other uses requested.

Dibutyl Phthalate—Granted in full for plastics (Classes I & II), synthetic rubber, coatings, adhesives, and cellophane. Granted in part for lacquers (72%), and miscellaneous small uses (74%).

Dicapryl Phthalate—Granted in full for plastics (Classes I & II). No other uses requested.

Dichlorethyl Ether—Denied for cleaning compounds and germicides. No other uses requested.

Dicyclohexyl Phthalate—Granted in full for lacquers. Denied for all other uses.

Diethoxy Ethyl Phthalate—Granted in full for lacquers. No other uses requested.

Diethyl Phthalate—Granted in part for plastics (Classes I & II) (98%). Other uses granted in part (91%—overall basis).

Diethylene Glycol—Granted in full for cutting oils, molding binder, and gas dehyration. Granted in part for general plasticizer (75%), for general textile (77%), for chemical manufacture (84%), and for tobacco humectant (43%).

Dimethoxy Ethyl Phthalate—Granted in full for plastics (Classes I & II) and cellophane. Only uses requested.

Dimethyl Phthalate—Granted in full for cable. Plastics (Classes I & II)

granted in part (95%). Other uses granted in part (85%—overall basis).

Dimethylcyclohexyl Phthalate—Granted in full for cellophane. No other uses requested.

Dioctyl Phthalate—Granted in full for cable and miscellaneous small uses. Granted in part for coatings (68%).

Diphenylamine—Granted in full for phenothiazine, dyes, smear 362, air brake and grease compound, drugs and soap anti-oxidant.

Domestic Coal Tar Cresols and Cresylic Acid—Granted in full for chlorinated phenols. Granted in part for medicinals (68%), disinfectants and insecticides (12%), dyes, pigments, and inks (10%), chemical manufacture (72%). All other uses denied, including minor non-essential chemical manufacturing, and plasticizer other than tricresyl phosphate.

Ethylene Glycol—Granted in full for all uses except chemical manufacturing (97%), and civilian antifreeze (96%).

Ethyl Cellulose—Granted in full in cases except where end use did not warrant and where substitutes might be used in food, transportation, communication, utilities, photography, industrial uses, printing and publishing. Denied for civilian cloth, furniture, and plastics.

Ethyl Phthalyl Ethyl Glycollate—Granted in full for miscellaneous small uses. Denied for coatings.

Furfural—Granted in full for civilian resins rated A-10 or higher, petroleum refining, and abrasive wheel binder. Granted in part (50%) for civilian resins rated lower than A-10, and for hydrogenation of furfural (50%).

Glycerine—Granted in full for all civilian uses rated A-1-k and higher. Granted in part for the following uses: drugs and pharmaceuticals (62%), synthetic resins (33%), ester gums (38%), rubber products (31%), gaskets and cork products (40%), cellulose films (70%), glassine and grease-proofing paper (50%),. printers' rollers (86%), printing supplies (45%), textiles (printing, dyeing, and finishing) (33%), adhesive (including book bindings) (38%), paper other than glassine and grease-proofing paper 58%), beverages (18%), flavoring extracts (42%), other edible products (58%), tobacco (48%), cosmetics, toilet preparations, dentifrices and shaving preparations (29%), wetting agents (37%), other chemical manufacture (67%).

Denied for triacetin and diacetin and candy and gum.

Methyl Ethyl Ketone—Allocated in full for dewaxing lubricating oils, cellulose acetate, inks and rotogravures, synthetic rubber, vinylite coatings and textiles. Granted in part for lacquers and thinners (47%) and cleaners and removers (47%).

Methyl Phthalyl Ethyl Glycollate—Granted in full for plastics (Classes I and II) and adhesives. No other uses requested.

Mineral Oil Polymers—Granted in full for composition floor tiles, protective coatings, printing inks and fiber board impregnant.

Mixed Glycols—Granted in full for all uses except civilian anti-freeze. Denied for civilian anti-freeze.

Naphthalene—Granted in full for all uses except moth prevention. Allocations for this purpose were on the basis of 90% of the average monthly consumption for this purpose during the first quarter of 1941.

Naphthenates—Granted in full for the following uses: industrial, agricultural and structural equipment; transportation, communication and utilities; cleaning and degreasing; and food.

Napthenic Acid—Granted in full for chemical uses. Denied for textile treating.

Nitrocellulose—Granted in full for the following uses: shoes, metal button lacquer, collodion, medical equipment, raincoats, moisture-proof coatings for food, bottle closure linings, food labels, sausage casing, auto refinishing, radio, telephone, machines and machine tools, power belting, electrical equipment and supplies, tape, casting sealer, rotogravure inks, book cloth, tracing cloth, stencil, drawing instruments, model airplanes, oil container, Class I plastics, photographic film (subject to L order), cellophane coating (subject to L order), motion picture screens.

Granted in part for: water-proof sheeting (75%); baby pants (75%), dress shields (75%), fountain pens (50%), furniture (50%), furniture undercoatings 75%).

Denied for handbags, belts, luggage, hats, fingernail polish, wearing apparel, decorative food uses, furniture, upholstery (except transcription) window shades (except government agencies) floor covering, oil cloth, transcription (except central station, recreation and amusement), jewelry and novelties, sporting goods and caskets.

Normal Butyl Alcohol—Granted in full for resins and plastics. Following uses granted in part: butyl acetate (64%); dibutyl phthalate (17%); butyl cellosolve (67%); other butyl derivatives (60%); hydraulic brake fluids (39%); photographic and reproduction (95%); medicinal and pharmaceutical (97%); textiles and coated fabrics (42%); chemical manufacture (92%); and industrial protective coatings (38%). Denied for cellulose acetobutyrate and oil additives.

Oiticica Oil—Granted for food containers and insulation. Denied for industrial equipment, chemical resistant finishes, furniture wood products, special printing inks, and in cases where no breakdown on end use was given on the application.

Para Phenyl Phenol Resin—Granted in part (60%) for electrical equipment, containers, paper liners for bottle caps, coated abrasives, road building and railroad equipment, machinery.

Petroleum Sulfonates—Granted in full for rust preventive, fat splitting, antifreeze compounds, lubricant additives, tetraethyl compound, metal cleaning, cutting oil, petroleum emulsion breaking, printing ink, detergent and wetting agents, drawing compound, and rubber processing. Granted in part (50%) for textile oil and leather oil. Denied for dry cleaning.

Phenol—Allocated for medicinals on the basis of 70% of 1941 average monthly consumption. Granted (80%) for disinfectant and preservatives with no domestic cresol and cresylic acid being allocated for this purpose. Dyes, pigments and inks granted 50%. Chlorinated phenols were granted 50%. Chemical manufacture granted 85%. Phenolic resins granted 66%. Triphenyl phosphate granted in full. Substituted phenols 69%.

Phenols, Substituted—Granted in full for oil additives and in part for disinfectants and preservatives (94%).

Phenolic Resins—Specialty Products—Granted in full for industrial water purification. Granted in part (90%) for electrical insulation. Granted in part (85%) for abrasives, bonded saturated asbestos structures, corrosion resistant construction material, lamp and tube basing. Granted in part (50%) for industrial heat insulation and equipment. Denied for all other uses.

Phosphorus—Following uses granted in full: matches, sugar refining, activated carbon, fertilizer and coumarin. The following were granted in part: power plant chemicals (85%) pharmaceuticals (80%), dyestuffs (75%), fire retardants (90%), acid leavening (71%), yeast (90%), industrial detergents (40%), industrial soaps (40%), household detergents (40%), household soaps (40%), dentrifrices (80%), glass (50%), wood pulp treatment (66%), beverages (50), gelatin (80%), salt conditioner (85%), and other food uses (85%).

Phthalic Alkyd Resins—Granted in part (75%) for medical-pharmaceutical and health supplies, food and beverage containers, first aid equipment, utilities, printing and publishing. Granted in part (50%), for agricultural machinery, construction machinery, commercial food purposes, clothing plants and equipment. Granted in part (25%) for hotels, apartments, offices and domestic furniture.

Phthalic Anhydride—Granted in full for resins, esters, dyes and intermediates, and food and drugs, except in individual cases where the request was inflated or the applicant had on hand an excessive inventory.

Polyvinyl Formal—Denied for all civilian uses.

Polyvinyl Alcohol—Granted in full for zinc anodes and for molded plastics. Granted in part for adhesives (33%)—overall basis, since insufficient information was given on some applications. Denied for experimentation.

Polyvinyl Acetate—Granted in full for experimental purposes (small quantities), for photo paper (small quantities), and for batteries (small quanties). Granted in part (44%) for essential civilian adhesives. Other civilian adhesives granted in part (11.1%) from inventory.

Polyvinyl Butyral—Denied for all civilian uses.

Potassium Chlorate—Granted in full for railroad torpedoes and fuses, pharmaceutical purposes, fur carroting and dyeing, and chemical processing. Granted in part for matches (95%).

Potassium Perchlorate—Granted in full for railway flares and mining explosives.

Propylene Glycol—Granted in full for all uses for which it was requested.

Pyrethrum—Granted in part for food protection (59%) and for general insecticide (40%).

Pyridine—Granted in full for sulfa drugs, other medicinals, zelan and vitamins.

Rapeseed Oil—Granted in full for pharmaceuticals. Granted in part for rubber compounding (75%) and insulation (75%). Denied for lacquer for wood products.

Saran—Granted in full for tubing, molded, rigid sheeting. Granted in part for filament (85%).

Secondary Butyl Alcohol—Granted in full for hydraulic brake fluids and rubber plasticizers. Granted in part for lacquer and thinners (80%) and for solvents (cleaning) (68%).

Shellac—The following uses, which consume relatively small quantities of shellac, were granted in full: zinc engraving-, photo-, drawing ink, correction fluid, tracing ink; printing compound; cement for musical instruments; candy; central base plates, sand discs; cement, opticians—pitch lens, lamps; binding agents; pharmaceuticals—health goods, medicinal tablets; and mimeograph stencil, addressograph. The following uses were granted in part: hats (33%); leather finishes (50%); and shoes (53%). The following uses were denied: fruits, vegetables; floors; maintenance and repair; phonograph records; linoleum; conveyors; mirrors; and experimentation.

Silica Gel—Granted in full for all uses for which it was requested.

Sodium Chlorate—Granted in full for colors, dyes and intermediates, for chemical processing, and for textile processing, printing, or dyeing. Granted in part for weed control (95%) and for soot removing compounds (50%).

Sodium Nitrate—Granted in full for all uses for which it was requested.

Sperm Oil—Granted in full for cutting oil, drawing compounds, lubricants, additives and quenching oil. Denied for use i[illegible] leather products. Allocations have not ye[illegible] been made for duplicating carbon and textile oil. These will be reported at [illegible] later date. In addition, small quantitie[illegible] of sperm oil were allocated for miscella[illegible]neous essential uses.

Styrene—None allocated for civilia[illegible] use.

Toluene—Granted in full for medicinals. Granted in part for dyes and intermediates (43%), food preservatives (22%) miscellaneous chemicals (23%), laboratory and research (10%). Denied for protective coatings, cleaning and solvents.

Tricresyl Phosphate—Denied for all civilian uses.

Triethylene Glycol—Granted in part for general plasticizer (54%) and chemical manufacture (85%).

Triphenyl Phosphate—Granted in full for all uses for which it was requested.

Sulfamic Acid and Derivatives—Granted in part for the manufacture of dry colors (60%) and for flame-proofing textiles (10%).

Tertiary Butyl Alcohol—Allocated in full for all civilian requests. Uses permitted were: paratertiary butyl phenol, lubricants (rayon), solvents, printing inks, detergents.

Theobromine—Granted in full for civilian medicinal requirements. Adjustments were made to allow distributors a 60-day inventory and pharmaceutical manufacturers a 90-day inventory.

Tung Oil—Granted in full for insulation, chemical resistant coatings, industrial tape, brake linings, and printing inks and mats. Slightly less than 5% of the total amount of tung oil authorized was allocated for use of implements of war only as defined by Amendment 1 to General Preference Order M-71. The following uses were granted in part: food container coatings (99%), coated fabrics (91%) and industrial coatings (31%).

Vinyl Acetate Monomer—Denied for all civilian purposes.

Vinylite VYHH—Granted in full for coated fabrics and coated paper. Granted in part for adhesives (40%), for molded plastics (23%). Denied for protective coatings.

CURRENT PRICES

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb.	$0.085–$0.109	$0.085–$0.109	$0.168–$0.173
Acid, acetic, 28%, bbl., cwt	3.38 – 3.63	3.38 – 3.63	3.38 – 3.63
Glacial 99.5%, drums	9.15 – 9.40	9.15 – 9.40	9.15 – 9.40
U. S. P. X 1, 99.5%, dr	10.95 –11.20	10.95 –11.20	10.95 –11.20
Boric, bbl., ton	109.00–113.00	109.00–113.00	109.00–113.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys, lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb	1.10 – 1.15	1.10 – 1.15	1.10 – 1.15
Hydrofluoric 30% drums, lb	.08 – .08½	.08 – .08½	.08 – .08½
Lactic, 44%, tech., light, bbl., lb.	.073– .075	.073– .075	.073– .075
Muriatic 18°, tanks, cwt	1.05 –......	1.05 –......	1.05 –......
Nitric, 36°, carboys, lb	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –20.00	18.50 –20.00
Oxalic, crystals, bbl., lb	.11¼– .13	.11¼– .13	.11½– .13
Phosphoric, tech., c'bys., lb	.07½– .08½	.07½– .08½	.7½– .08½
Sulphuric, 60°, tanks, ton	13.00 –......	13.00 –......	13.00 –......
Sulphuric, 66°, tanks, ton	16.50 –......	16.50 –......	16.50 –......
Tannic, tech., bbl., lb	.71 – .73	.71 – .73	.71 – .73
Tartaric, powd., bbl., lb	.70 –......	.70 –......	.70 –......
Tungstic, bbl., lb	nom	nom	nom ......
Alcohol, amyl	......–......	......–......	......–......
From Pentane, tanks, lb	.131–......	.131–......	.131–......
Alcohol, Butyl, tanks, lb	.12½– .14½	.12½– .14½	.158–......
Alcohol, Ethyl, 190 p'f., bbl., gal	8.19 – 8.25	8.19 – 8.25	8.19 – 8.25
Denatured, 190 proof	......–......	......–......	......–......
No. 1 special, dr., gal. wks.	.60 –......	.60 –......	.60 –......
Alum, ammonia, lump, bbl., lb	.03¾– .04	.03¾– .04	.03¾– .04
Potash, lump, bbl., lb	.04 – .04½	.04 – .04½	.04 – .04½
Aluminum sulphate, com. bags, cwt	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt	1.85 – 2.10	1.85 – 2.10	1.85 – 2.10
Aqua ammonia, 26°, drums, lb	.02½– .03	.02½– .03	.02½– .03
tanks, lb	.02 – .02¾	.02 – .02¾	.02 – .02¾
Ammonia, anhydrous, cyl., lb	.16 –......	.16 –......	.16 –......
tanks, lb	.04½–......	.04½–......	.04½–......
Ammonium carbonate, powd. tech., casks, lb	.09¼– .12	.09¼– .12	.09¼– .12
Sulphate, wks., ton	29.20 –......	29.20 –......	29.00 –......
Amylacetate tech., from pentane, tanks, lb	.145–......	.145–......	.145–......
Antimony Oxide, bbl., lb	.15 –......	.15 –......	.15 –......
Arsenic, white, powd., bbl., lb	.04 – .04½	.04 – .04½	.04 – .04½
Red, powd., kegs, lb	nom	nom	nom ......
Barium carbonate, bbl., ton	60.00 –65.00	60.00 –65.00	60.00 –65.00
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb	.11 – .12	.11 – .12	.11 – .12
Blanc fix, dry, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f.o.b., wks., drums, cwt	2.25 – 2.35	2.25 – 2.35	2.25 – 2.35
Borax, gran., bags, ton	44.00 –......	44.00 –......	44.00 –......
Bromine, cs., lb	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	3.00 –......	3.00 –......	3.00 –......
Arsenate, dr., lb	.07 – .08	.07 – .08	.06½– .07
Carbide drums, lb	.04¾– .05	.04¾– .05	.04¾– .05
Chloride, fused, dr., del., ton	18.00 –24.00	18.00 –24.00	18.00 –24.00
flake, bags., del., ton	18.50 –25.00	18.50 –25.00	18.50 –25.00
Phosphate, bbl., lb	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb	.05½–......	.05½	.05½–......
Tetrachloride drums, gal	.73 – .80	.73 – .80	.73 – .80
Chlorine, liquid, tanks, wks., 100 lb.	2.00 –......	2.00 –......	2.00 –......
Cylinders	.05¼– .06	.05½– .06	.05¼– .06
Cobalt oxide, cans, lb	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f.o.b., wks., ton	18.00 –19.00	18.00 –19.00	18.00 –19.00
Copper carbonate, bbl., lb	.18 – .20	.18 – .20	.18 – .20
Sulphate, bbl., cwt	5.15 – 5.40	5.15 – 5.40	5.15 – 5.40
Cream of tartar, bbl., lb	.57 –......	.57 –......	.57 –......
Diethylene glycol, dr., lb	.14 – .15½	.14 – .15½	.14 – .15½
Epsom salt, dom., tech., bbl., cwt.	1.90 – 2.00	1.90 – 2.00	1.90 – 2.00
Ethyl acetate, drums, lb	.12 –......	.12 –......	.12 –......
Formaldehyde, 40%, bbl., lb	.05½– .06	.05½– .06½	.05½– .06
Furfural, tanks, lb	.09 –......	.09 –......	.09 –......
Fusel oil, drums, lb	.18 – .19	.18 – .19	.18 – .19
Glaubers salt, bags, cwt	1.05 – 1.10	1.05 – 1.10	1.05 – 1.10
Glycerine, c.p., drums, extra, lb	.18¼–......	.18¼–......	.18¼–......

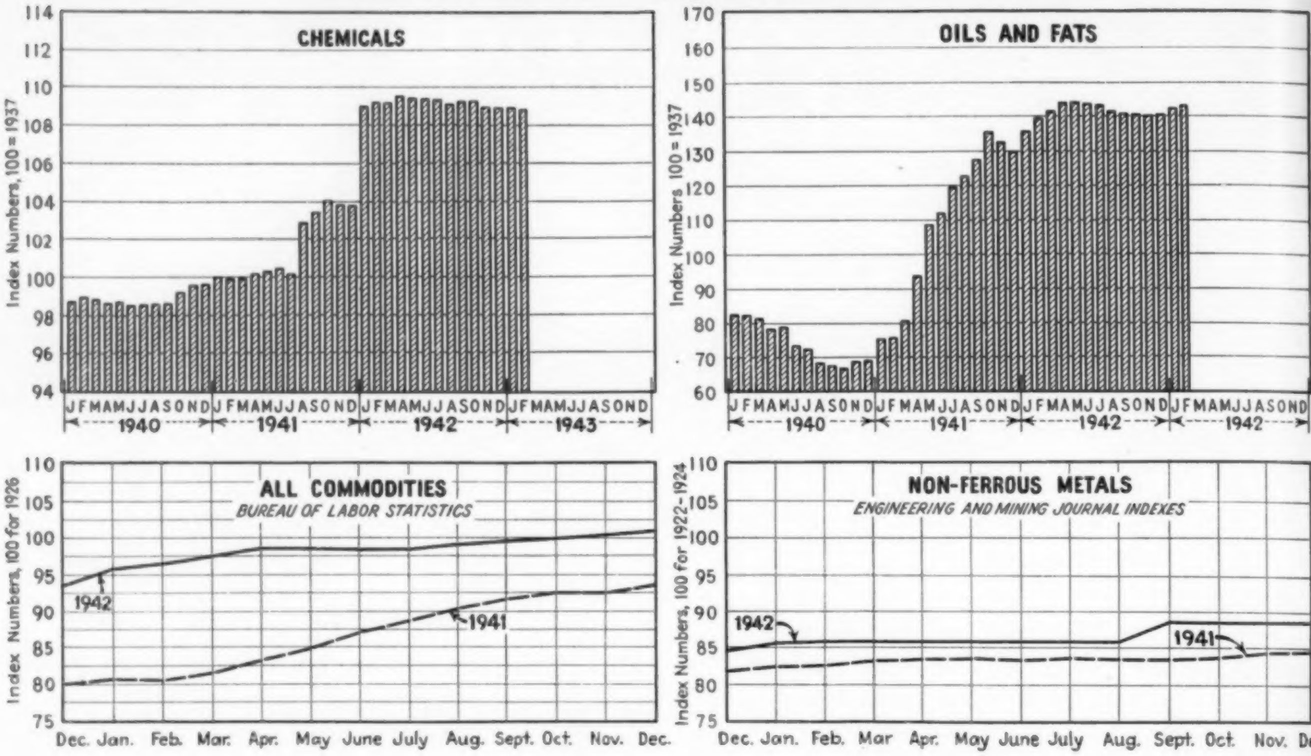
	Current Price	Last Month	Last Year
Lead:			
White, basic carbonate, dry casks, lb	.08¼–......	.08¼–......	.08¼–......
White, basic sulphate, sck., lb	.07¾–......	.07¾–......	.07¾–......
Red, dry, sck., lb	.09¼–	.09¼–......	.09¼–......
Lead acetate, white crys., bbl., lb.	.12¾– .13	.12¾– .13	.12 – .13
Lead arsenate, powd., bag, lb	.11 – .12	.11 – .12	.09½– .11
Lime, chem., bulk, ton	8.50 –......	8.50 –......	8.50 –......
Litharge, powd., csk., lb	.08½–......	.08½–......	.08½–......
Lithopone, bags, lb	.04¼– .04½	.04¼– .04½	.04¼– .04½
Magnesium carb., tech., bags, lb.	.06¼– .06½	.06¼– .06½	.06¼– .06½
Methanol, 95%, tanks, gal	.60 –......	.60 –......	.60 –......
97%, tanks, gal	.60 –......	.60 –......	.60 –......
Synthetic, tanks, gal	.28 –......	.28 –......	.28 –......
Nickel salt, double, bbl., lb	.13½– .13½	.13¼– .13½	.13½– .13½
Orange mineral, csk., lb	.12½–......	.12½–......	.12½–......
Phosphorus, red, cases, lb	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb.	.09⅜– .10	.09⅜– .10	.09⅜– .10
Carbonate, 80–85%, calc. csk., lb.	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb	.10 – .12	.10 – .12	.10 – .12
Hydroxide (c'stic potash) dr., lb.	.07 – .07¼	.07 – .07¼	.07 – .07¼
Muriate, 60% bags, unit	.53½–......	.53½–......	.53½–......
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb	.19½– .20	.19½– .20	.19½– .20
Prussiate, yellow, casks, lb	.17 – .18	.17 – .18	.17 – .18
Sal ammoniac, white, casks, lb	.0515– .06	.0515– .06	.0515– .06
Salsoda, bbl., cwt	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	17.00 –......	17.00 –......	17.00 –......
Soda ash, light, 58%, bags, contract, cwt	1.05 –......	1.05 –......	1.05 –......
Dense, bags, cwt	1.10 –......	1.10 –......	1.10 –......
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, del., bbl., lb	.05 – .06	.05 – .06	.05 – .06
Bicarbonate, bbl., cwt	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb	.07¾– .08	.07¾– .08	.07¾– .08
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	16.00 –17.00
Bisulphite, bbl., lb	.03 – .04	.03 – .04	.03 – .04
Chlorate, kegs, lb	.06¼– .06½	.06¼– .06½	.06¼– .06½
Cyanide, cases, dom., lb	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb	.08 – .09	.08 – .09	.08 – .09
Hyposulphite, bbl., cwt	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt	2.50 – 2.65	2.50 – 2.65	2.50 – 2.65
Nitrate, bulk, cwt	1.35 –......	1.35 –......	1.35 –......
Nitrite, casks, lb	.06¾– .07	.06¾– .07	.06¾– .07
Phosphate, tribasic, bags, lb	2.70 –......	2.70 –......	2.70 –......
Prussiate, yel. drums, lb	.10½– .11	.10½– .11	.10½– .11
Silicate (40° dr.), wks., cwt	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr. lb.	.03 – .03½	.03 – .03½	.03 – .03½
Sulphite, crys., bbl., lb	.02¼– .02½	.02¼– .02½	.02¼– .02½
Sulphur, crude at mine, bulk, ton.	16.00 –......	16.00 –......	16.00 –......
Chloride, dr., lb	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb	.07 – .08	.07 – .08	.07 – .08
Flour, bag, cwt	1.90 – 2.40	1.90 – 2.40	1.90 – 2.40
Tin Oxide, bbl., lb	.55 –......	.55 –......	.55 –......
Crystals, bbl., lb	.39½–......	.39½–......	.39½–......
Zinc, chloride, gran., bbl., lb	.05¾– .06	.05¾– .06	.05 – .06
Carbonate, bbl., lb	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb	.10¾–......	.10¾–......	.09¾–......
Zinc oxide, lead free, bag, lb	.07¾–......	.07¾–......	.07¾–......
5% leaded, bags, lb	.07⅛–......	.07⅛–......	.07⅛–......
Sulphate, bbl., cwt	3.85 – 4.00	3.85 – 4.00	3.40 – 3.50

OILS AND FATS

	Current Price	Last Month	Last Year
Castor oil, No. 3 bbl., lb	$0.13¾–$0.14½	$0.13¾–$0.14½	$0.12½–$0.13
Chinawood oil, bbl., lb	.38 –......	.38 –......	.38 –......
Coconut oil, Ceylon, tank, N. Y., lb	nom	nom	nom ......
Corn oil crude, tanks (f.o.b. mill), lb	.12¾–......	.12¾–......	.12¾–......
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.12¾–......	.12¾–......	.12⅝–......
Linseed oil, raw car lots, bbl., lb.	.14 –......	.134–......	.117–......
Palm, casks, lb	.09 –......	.09 –......	.09 –......
Peanut oil, crude, tanks (mill), lb.	.13 –......	.13 –......	.13 –......
Rapeseed oil, refined, bbl., lb	nom	nom	nom ......
Soya bean, tank, lb	.11¾–......	.11¾–......	.11¾–......
Sulphur (olive foots), bbl., lb	nom	nom	.19 –......
Cod, Newfoundland, bbl., gal	nom	nom	nom ......
Menhaden, light pressed, bbl., lb.	.117–......	.117–......	.112–......
Crude, tanks (f.o.b. factory) lb.	.088–......	.088–......	.08 –......
Grease, yellow, loose, lb	.08¼–......	.08¼–......	.09295.....
Oleo stearine, lb	.09½–......	.09½–......	.09½–......
Oleo oil, No. 1	.11½–......	.11½–......	.11½–......
Red oil, distilled, dp.p. bbl., lb	.11¼–......	.11–¼......	.12 –......
Tallow extra, loose, lb	.08⅜–......	.08⅜–......	.097125....

The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to February 15

Chem. & Met.'s Weighted Price Indexes



Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52– $0.55	$0.52– $0.55	$0.52 –$0.55
Alpha-naphthylamine, bbl., lb.	.32 – .34	.32 – .34	.32 – .34
Aniline oil, drums, extra, lb.	.15 – .16	.15 – .16	.15 – .16
Aniline, salts, bbl., lb	.22 – .24	.22 – .24	.22 – .24
Benzaldehyde, U.S.P., dr., lb.	.85 – .95	.85 – .95	.85 – .95
Benzidine base, bbl., lb	.70 – .75	.70 – .75	.70 – .75
Benzoic acid, U.S.P., kgs., lb.	.54 – .56	.54 – .56	.54 – .56
Benzyl chloride, tech., dr., lb.	.23 – .25	.23 – .25	.23 – .25
Benzol, 90%, tanks, works, gal.	.15 –......	.15 –......	.14 –......
Beta-naphthol, tech., drums, lb.	.23 – .24	.23 – .24	.23 – .24
Cresol, U.S.P., dr., lb	.11 –......	.11 – .11	.10¾– .11
Cresylic acid, dr., wks., gal	.81 – .83	.81 – .83	.81 – .83
Diethylaniline, dr., lb.	.40 – .45	.40 – .45	.40 – .45
Dinitrophenol, bbl., lb	.23 – .25	.23 – .25	.23 – .25
Dinitrotoluol, bbl., lb	.18 – .19	.18 – .19	.18 – .19
Dip oil, 15%, dr., gal	.23 – .25	.23 – .25	.23 – .25
Diphenylamine, dr. f.o.b. wks., lb.	.60 –......	.60 –......	.70 –......
H-acid, bbl., lb	.45 – .50	.45 – .50	.45 – .50
Naphthalene, flake, bbl., lb	.07 – .07½	.07 – .07½	.07 – .07½
Nitrobenzene, dr., lb	.08 – .09	.08 – .09	.08 – .09
Para-nitraniline, bbl., lb.	.47 – .49	.47 – .49	.47 – .49
Phenol, U.S.P., drums, lb.	.10½– .11	.12 – .13	.13 –......
Picric acid, bbl., lb	.35 – .40	.35 – .40	.35 – .40
Pyridine, dr., gal	1.70 – 1.80	1.70 – 1.80	1.70 – 1.80
Resorcinol, tech., kegs., lb.	.75 – .80	.75 – .80	.75 – .80
Salicylic acid, tech., bbl., lb.	.33 – .40	.33 – .40	.33 – .40
Solvent naphtha, w.w., tanks, gal.	.27 –......	.27 –......	.27 –......
Tolidine, bbl., lb	.86 – .88	.86 – .88	.86 – .88
Toluol, drums, works, gal	.33 –......	.33 –......	.32 –......
Xylol, com., tanks, gal	.26 –......	.26 –......	.26 –......

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton	$22.00–$25.00	$22.00–$25.00	$22.00–$25.00
Casein, tech., bbl., lb	.19 – .20	.19 – .20	.25½– .29
China clay, dom., f.o.b. mine, ton.	8.00 –20.00	8.00 –20.00	8.00 –20.00
Dry colors			
Carbon gas, black (wks.), lb.	.0335– .30	.0335– .30	.0335– .30
Prussian blue, bbl., lb.	.36 – .37	.36 – .37	.36 – .37
Ultramarine blue, bbl., lb.	.11 – .26	.11 – .26	.11 – .26
Chrome green, bbl., lb.	.21½– .30	.21½– .30	.21½– .30
Carmine, red, tins, lb	4.60 – 4.75	4.60 – 4.75	4.60 – 4.75
Para toner, lb.	.75 – .80	.75 – .80	.75 – .80
Vermilion, English, bbl., lb.	3.05 – 3.10	3.05 – 3.10	3.05 – 3.10
Chrome yellow, C.P., bbl., lb.	.14½– .15½	.14½– .15½	.14½– .15½
Feldspar, No. 1 (f.o.b.N.C.), ton.	6.50 – 7.50	6.50 – 7.50	6.50 – 7.50
Graphite, Ceylon, lump, bbl., lb.	.08 – .10	.08 – .10	.08 – .10
Gum copal Congo, bags, lb	.09 – .30	.09 – .30	.09 – .30
Manila, bags, lb.	.09 – .15	.09 – .14	.09 – .15
Demar, Batavia, cases, lb	.10 – .22	.10 – .20	.10 – .22
Kauri, cases, lb	.18 – .60	.17 – .60	.18 – .60
Kieselguhr (f.o.b. mines), ton	7.00 –40.00	7.00 –40.00	7.00 –40.00
Magnesite, calc, ton	64.00 –......	64.00 –......	64.00 –......
Pumice stone, lump, bbl., lb	.05 – .07	.05 – .08	.05 – .07
Imported, casks, lb	nom	nom	nom ......
Rosin, H., 100 lb.	4.10 –......	4.10 –......	3.90 –......
Turpentine, gal	.70 –......	.70 –......	.81½–......
Shellac, orange, fine, bags, lb.	.39 –......	.39 –......	.43 –......
Bleached, bonedry, bags, lb.	.39 –......	.39 –......	.40 –......
T. N. bags, lb.	.31 –......	.31 –......	.32 –......
Soapstone (f.o.b. Vt.), bags, ton.	10.00 –12.00	10.00 –12.00	10.00 –12.00
Talc. 200 mesh (f.o.b. Vt.), ton.	8.00 – 8.50	8.00 – 8.50	8.00 – 8.50
200 mesh (f.o.b. Ga.), ton	6.00 – 8.00	6.00 – 8.00	6.00 – 8.00

Industrial Notes

JOSHUA HENDY IRON WORKS, Sunnyvale, Calif., has acquired the Crocker-Wheeler Electric Mfg. Co., Ampere, N. J., and the Pomona Pump Co., Pomona, Calif. and St. Louis, Mo., together with its subsidiary the Westco Pump Division.

ALLEGHENY LUDLUM SEEL CO., Pittsburgh, has advanced Robert H. Gibb to the position of district manager.

UNION BAG & PAPER CORP., New York, has appointed Donald J. Hardenbrook assistant to the president. He will continue to have responsibility for post war planning to which duties he recently was assigned.

REICHHOLD CHEMICALS, INC., Detroit, has opened offices at 30 Rockefeller Plaza, New York, which will house the sales and purchasing departments for its Elizabeth, N. J., plant and also the export department. E. A. Terray will be in charge of the new office with F. A. Jolles in charge of exports.

INLAND STEEL CO., Chicago, has changed the name of its subsidiary, the Wilson & Bennett Mfg. Co. to the Inland Steel Container Co.

THE FLUOR CORP., LTD., Los Angeles, has opened an office at 30 Rockefeller Plaza New York, with J. I. Lawrence formerly of the company's Kansas City office in charge.

E. F. DREW & CO., New York, has appointed Robert Bruce as advertising and publicity manager.

THE AUSTIN CO., Cleveland, has elected W. G. Paton of Cleveland and W. R. Engstrom of Seattle, vice-presidents of the company.

KIMBERLY-CLARK CORP., Neenah, Wisc., has assigned W. M. Wright to act as temporary purchasing agent to relieve L. C. Stilp who will devote his entire time to purchasing for the ordnance division.

AMERICAN-MARIETTA CO., Chicago, has acquired the Ferbert-Schorndorfer Co. of Cleveland and will operate it as a subsidiary. David Andrew will continue to serve as president.

THE COOPER-BESSEMER CORP., Mount Vernon, Ohio, has transferred Philip W. Mettling, compressor expert, from Mount Vernon to the company's office at 640 East 61 St., Los Angeles.

WESTINGHOUSE ELECTRIC & MFG. CO., East Pittsburgh, announces that Charles F. Billings for 19 years assistant superintendent of the lamp division plant at Trenton has been appointed industrial relations manager of the division with headquarters at Bloomfield, N. J.

ATLAS POWDER CO., Wilmington, has appointed Frank J. Horty director of a newly formed service department and John Swenehart director of the advertising and public relations department.

NEW CONSTRUCTION

	Current Projects		Cumulative 1943	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$40,000	$80,000	$80,000	$80,000
Middle Atlantic	120,000	50,000	240,000	50,000
South	40,000	....	40,000	....
Middle West	80,000	7,150,000	3,330,000	7,330,000
West of Mississippi	40,000	1,260,000	1,120,000	1,260,000
Far West	....	....	240,000	....
Canada	2,995,000	147,000	3,185,000	147,000
	$3,315,000	$8,687,000	$8,235,000	$8,867,000

PROPOSED WORK

Conn., Norwalk — Dilik Experimental Laboratories, Norwalk, contemplate the construction of a brick factory, including office and warehouse. Estimated cost $40,000.

Ill., Cicero—America Phenolic Corp., 1830 South 54th St., Chicago, is having plans prepared by Burnham & Hammond, Archts., 160 North La Salle St., Chicago, for the construction of a factory.

La., Marrero—Celotex Corp., 910 North Michigan Ave., Chicago, Ill., manufacturer of building board products, insulating board, etc., contemplates expanding some of its plants now manufacturing new products.

Missouri—U. S. Government, Washington, D. C., plans the construction of a grain alcohol manufacturing plant.

N. J., Jersey City—Metro Glass Bottle Co., 135 West Side Ave., plans the construction of a 2 story concrete factory. Estimated cost $40,000.

Ohio, Lima—The Frederick Paper & Twine Co., 216 North Main St., manufacturer of commercial paper products, plans to rebuild that portion of its storage and distributing plant recently destroyed by fire.

Pa., Glen Olden—Sharp & Dohme, South Ave. and Chester Park, are having plans prepared by the United Engineers & Constructors, Inc., 1401 Arch St., Philadelphia, for the construction of a research laboratory here.

Pa., Philadelphia — Publicker Alcohol Co., 1429 Walnut St., is having plans prepared by Silverman & Levy, Archts., Architects Bldg., for the construction of a pilot plant and granary at Delaware Ave. and Begler St.

N. B., Dalhousie—New Brunswick International Paper Co., Ltd., Sun Life Bldg., Montreal, Que., plans to remodel its plant here.

Ont., Espaula — Kalamazoo Vegetable Parchment Co., Kalamazoo, Mich., plans to convert paper mill here into a sulphate mill and also build an extension to the plant. Estimated cost between $2,500,000 and $3,000,000.

Ont., Hamilton—Sir Walter Carpenter, c/o Office of City Clerk, Hamilton, and Vancouver, B. C., plans to construct a plant for processing linseed oil from flaxseed, also other oils from soya beans. Estimated cost $75,000.

Ont., Toronto—Adelaide Metal Processes, Ltd., c/o P. C. Finlay, 138 Lytton Blvd., plans the construction of a chemical, metallurgical and electrometallurgical plant. Estimated cost $40,000.

Ont., Toronto—Mundet Cork & Insulation, Ltd., 35 Booth Ave., is having plans prepared by Margison & Babcock, Archts., 210 West Dundas St., for the construction of a 78x100 ft. brick addition to its plant. Estimated cost $40,000.

Que., Cap de la Madeleine—Dominion Rubber Co., Ltd., 550 Papineau Ave., Montreal, plans to remodel its plant here and also construct additions. Estimated cost $50,000.

CONTRACTS AWARDED

Conn., Torrington—Torrington Manufacturing Co., 70 Franklin St., has awarded the contract for the construction of a 2 story brick laboratory addition on Treat St., to Torrington Building Co., 187 Church St. Estimated cost $40,000.

Md., Baltimore—Air Reduction Sales Co., 17 St. and Allegheny Ave., Philadelphia, Pa., has awarded the contract for the construction of an acetylene plant on Chesapeake Ave., to Heverstick Borthwick Co., Schaaf Bldg., Philadelphia, Pa. Estimated cost will exceed $50,000.

Ohio, Cleveland — Cleveland Graphite Bronze Co., F. Salzman, 16800 St. Clair Ave. in charge, has awarded the contract for the construction of a 1 story, 100x240 ft. addition to its plant to Albert M. Higley Co., 2036 East 22nd St. Estimated cost $75,000.

Ohio, Cleveland—Industrial Rayon Corp., c/o George Torrance, 9801 Walford Ave., has awarded the contract for the construction of a 2 story, 36x43 ft. and a 1 story 120x180 ft. additions to its factory to George A. Rutherford Co., 2725 Prospect Ave. Estimated cost $75,000.

Ohio, Cleveland—Standard Oil Co. of Ohio, 3083 Broadway, has awarded the contract for the construction of a gasoline cracking plant to E. B. Badger & Sons Co., 75 Pitt St., Boston, Mass.; concrete foundation to H. K. Ferguson Co., Hanna Bldg., Cleveland. Estimated cost $7,000,000.

Rhode Island—U. S. Rubber Co., 355 Valley St., Providence, has awarded the contract for the construction of a 1 story addition to its plant to H. V. Collins, 7 Dyer St., Providence.

Texas—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., has awarded the contract for the construction of an oxygen plant to F. H. McGraw & Co., 51 East 42nd St., New York, N. Y. Plant will be leased to Air Reduction Sales Co., 2005 Collingsworth St., Houston. Estimated cost of completed job $475,000.

Texas—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., has awarded the contract for the construction of a laboratory building and facilities to be leased to the Crown Central Petroleum Corp., Pasadena, to Andrew Ness Construction Co., 200 Portwood St., Houston. Estimated cost $40,000.

Texas—Defense Plant Corp., 811 Vermont Ave., N. W., Washington, D. C., has awarded the contract for the construction of additional plant buildings to Frick-Reid Supply Corporation, Texas City. Plant will be operated by Republic Oil Refining Corporation, Texas City. Estimated cost $245,000.

Wyo., Lusk—Continental Oil Co., Lusk, has awarded the contract for constructing and equipping a butane gas plant to Stearns-Roger Manufacturing Co., 1720 California St., Denver, Colo. Estimated cost will exceed $500,000.

N. B., St. John—Canada Veneer Co., Ltd., 7 Wall St., has awarded the contract for the construction of a factory to John Flood & Sons, Ltd., 111 Princess St., at $146,640.